

PUBLIC WORKS Magazine

Founded in 1896

Devoted to the interests of the engineers and technical officials of cities, counties and states

Vol. 78, No. 11

W. A. HARDENBERGH and A. PRESCOTT FOLWELL
Editors

NOVEMBER, 1947, CONTENTS

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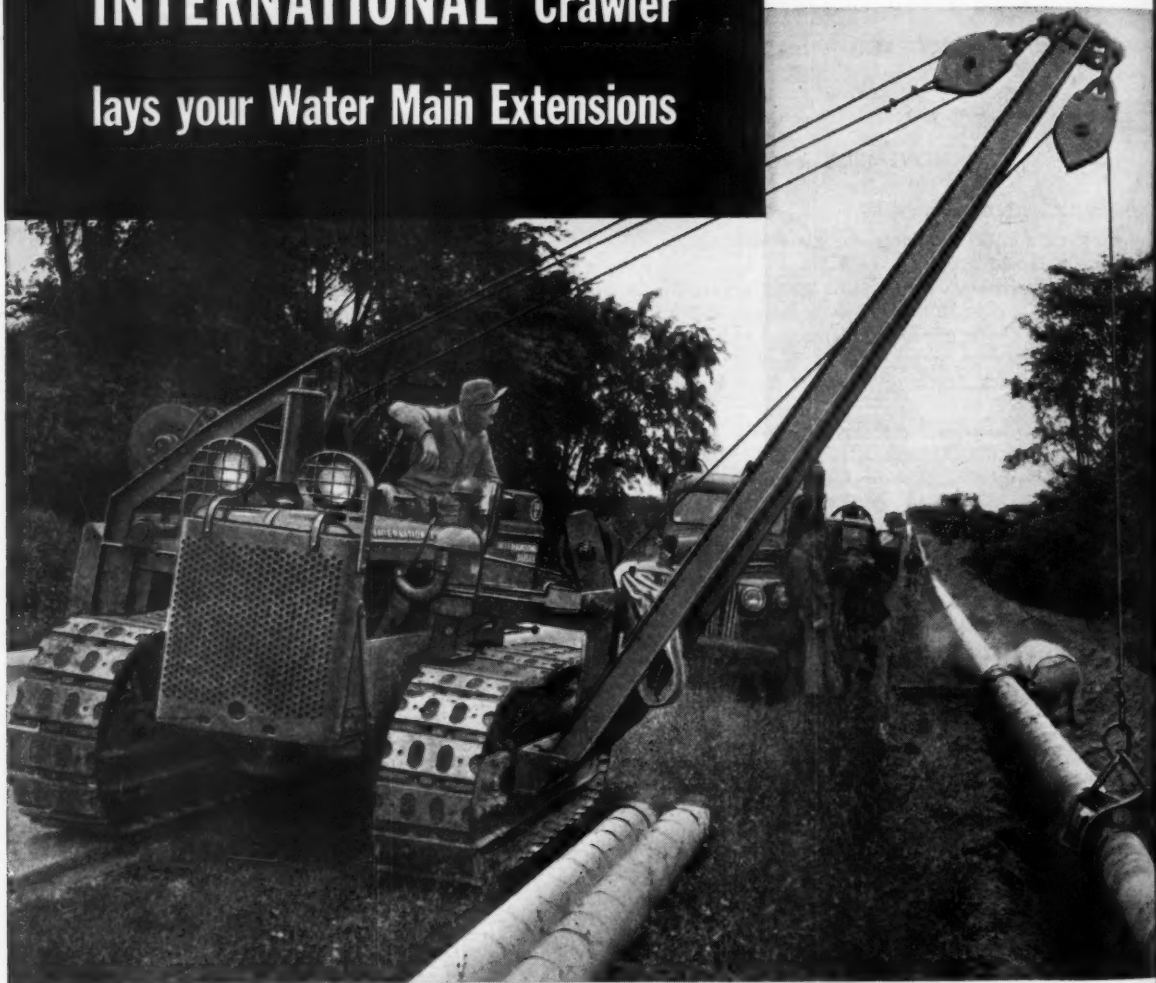
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The Editor's Page

Changes in Civil Engineering Curricula

Fundamental changes in the civil engineering curriculum at Massachusetts Institute of Technology have been announced, effective with this academic year. The new curriculum recognizes the three phases of conception, design and construction. The first of these includes administration, a matter in which too many engineers have been sadly deficient. The second prepares for design, research and teaching. The third emphasizes construction. This is a much needed advance, but more changes are needed in our civil engineering training. In brief, these changes should insure that a reasonable number of graduates are, while thoroughly grounded in the technical phases of their work, also inoculated with some vision, aggressiveness, willingness to take responsibility, and interest in other than relatively narrow technical matters. A little imagination would also help in many cases.

Radio-Telephone in Highway Maintenance

Now that six usable frequencies have been allocated to highway departments by the Federal Communications Commission, there should be a greater use of this facility by states, counties and cities. Several articles have been published in this magazine, and more are scheduled for early publication. These articles describe the ways in which two-way radio-telephone can be used to promote better highway service for the taxpayer. Among them are snow removal, in which outstanding results are already at hand; traffic control; maintenance; and emergency repairs. There is also a big field for money-saving use of two-way radio in large-city water works maintenance.

Water-Borne Disease Outbreaks and What Causes Them

For the first time in ten years there are available complete data on water-borne disease outbreaks practically to date. There are many lessons to be learned from the tabulation of the causes behind these outbreaks. Most of the failures were human; few of them were due to breakdowns or deficiencies of mechanical equipment. We have the tools and the knowledge but we do not have the properly trained personnel to get the most out of the assets we have.

More and better training is at least one answer to this problem. The 29 disease outbreaks in the 1938 to 1945 period which were chargeable to inadequate or interrupted chlorination caused 13,346 cases of disease. Most or all of these outbreaks occurred because the operator did not appreciate the necessity for continuous adequate chlorination. Proper emphasis on this subject in a training program will reduce future disease incidence from this cause. Cross-connections were responsible for 30 outbreaks and 46,497 cases of disease. Few of our water works supervisory personnel know how great a hazard cross-connections actually present, and fewer still are qualified to make a survey to determine what the conditions in their own community actually are, or to take any sound steps toward remedying the hazards that they know exist.

These are only the highlights of the report, which appears on another page of this issue. Interesting as the data presented are, they are valuable only if we use them to do a better job in the future. If anyone has a better plan than that represented by a sound training program for water department personnel, we would like to hear from them.

Inadequate Snow Removal Cuts Gas-Tax Income

State highway departments can lose considerable gas-tax revenue by failing to keep roads open for winter traffic. In one northern state, only 40 per cent as much taxable gasoline is sold in midwinter as in midsummer. This is no doubt an exceptional case, but those states that maintain snow-free roads have found that gas-tax income remains high all winter with only a slight decrease after severe storms. It often costs less to remove the snow than not to do so. This is especially the case to-day when modern equipment and procedures are available which so greatly reduce the cost and speed up the work. The use of chemicals; cinder spreaders; loaders; fast snow plows; and overall, efficient control, by radiotelephone, has made it possible to open roads quickly after a storm and to make them and keep them satisfactorily safe for traffic.

Engineering As She Is Writ

The life of an editor is occasionally enlivened by strange statements in the articles that come to him, though usually it turns out that these do have sound basis for fact, once interpreted. There is the slope that has a grade of 117 per cent; the cost "which is two and three-quarters times less"; the labor requirement which is between "two and three men per task"; and the anchor "between each post." We'll be glad to have others; in fact, we might build up a bit of a collection. Send yours in.

Public Relations Values for the Highway Engineer

Engineers are notoriously lacking in public relations work, and are thereby handicapped in gaining the public appreciation and esteem that they might well have, as well as the public support often essential to a sound highway program. Closer contact with the local newspaper editor, and an occasional ride over the highway system with him to show work that is under way; frequent brief news items to the papers on road conditions, snow or ice, construction and maintenance operations; talks to luncheon clubs; speaking to school children, or having them visit the plant or shop—all of these will go a long way in making the local taxpayer feel that he is getting his money's worth in road construction and maintenance. What is an old story to you may be full of interest to other folks who sell groceries, or run the bank, but who pay for the road system.

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Letters to the Editor

Sorry; Apologies Herewith

DEAR COL. HARDENBERGH:

I was very much surprised to note a rather glaring omission in your article "On The Job Training For Water Works Personnel," starting on page 38 in your September issue. In section 31 you refer quite properly to the need for sterilizing the jute or oakum used in making water pipe joints. But you omit entirely to mention our product FIBREX which obviates this necessity. FIBREX will not support the growth of bacteria thus overcoming one of the undesirable features of jute. It has won the endorsement of State Health Departments all over the country and water works men who have used it say they will never go back to jute. Besides insuring sterile mains FIBREX is easier to use since it packs into the joints more readily due to its high compressibility. It is more economical since 70 pounds will go as far as 100 pounds of braided jute, due to greater yardage per pound. We feel that FIBREX should have been mentioned since it is a very definite step forward in the field of joint making.

R. F. HAYES,
General Sales Manager,
Hydraulic Development Corporation

Sent With Pleasure

DEAR SIR:

I noticed in your July, 1947, issue of PUBLIC WORKS an article entitled "Outline For An On-The-Job Training Program for Water Department Personnel." There was a notation that the second installment of this article would be published in the September issue. I would greatly appreciate it if it would be possible to get one or more reprints of these articles and any expense attached thereto would be gladly forwarded.

RAY L. DERBY,
Principal Sanitary Engineer,
Department of Water and Power
Los Angeles, Calif.

Small Treatment Plants

DEAR SIR:

Your article on the design of Imhoff Tanks in the September issue of PUBLIC WORKS was well timed and highly appreciated. One of the small communities in this area has employed

me to design and prepare plans for such a plant.

Please send me the data covering small rotary and fixed nozzle distributors for trickling filters. Additional information or references concerning the design of small sewage disposal plants would also be appreciated.

ROBERT W. KELLEY, JR.,
Civil Engineer,
Houston, Texas

Information Please

DEAR SIR:

I would be pleased to have your comments on the questions submitted below, as I am unable to find satisfactory explanations in texts or other publications at hand:

1. What factors, other than thorough admixture of air, require detention periods of from four to six hours in aeration tanks, for proper operation of the activated sludge process.

2. What factors, other than temperatures of some 145 deg. F, have retarded the use of thermophilic digestion of sewage sludge.

PHILIP S. WICKERHAM,
Consulting Engineer,
Portsmouth, Ohio

Glad You Like It

DEAR SIR:

We have been very interested in the articles appearing in PUBLIC WORKS Magazine during the past year, in fact, we have found it necessary to hide our copies to prevent them from disappearing.

In your September issue there is an article on Page 33 entitled "How to Design Imhoff Tanks and Trickling Filters for Schools, Camps and Hotels." This article contains exactly the information required by officers who have to install small systems and we are asking your permission to reprint it in the January issue of CEC Bulletin—with full credit, of course. It has been very difficult to find an article on this subject which comes within the scope of camp construction, which is the reason we are so anxious to use this one.

EDWARD E. THORP,
Editor CEC Bulletin,
Navy Department

Thank You!

Gentlemen:

I want to hand you my check for \$3 for one year's subscription to PUBLIC WORKS Magazine. I used to be a subscriber for many years, but dropped some of these journals.

There is so much in your journal that I just have to take it on again. Every now and then I read one in some office.

HENRY A. MENTZ

Hammond, La.

city of

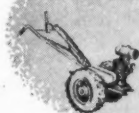
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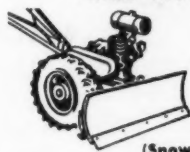
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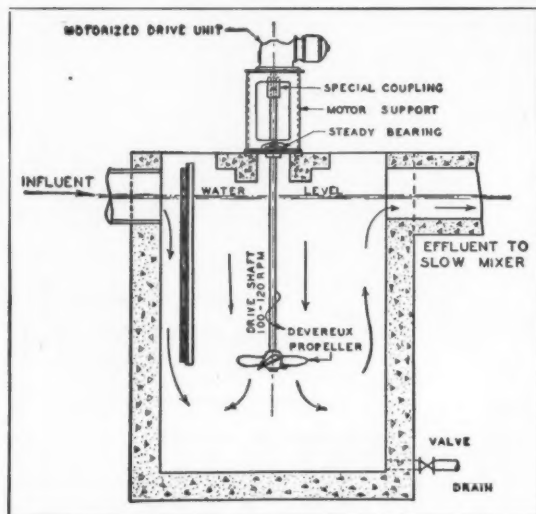
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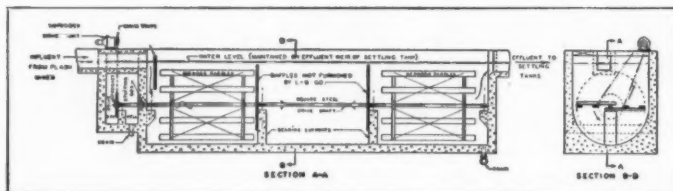
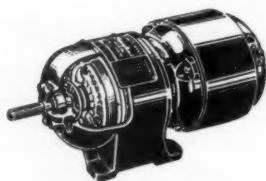
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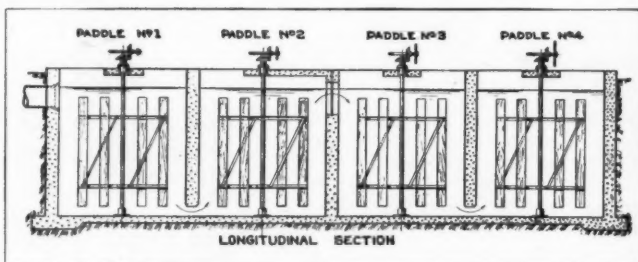
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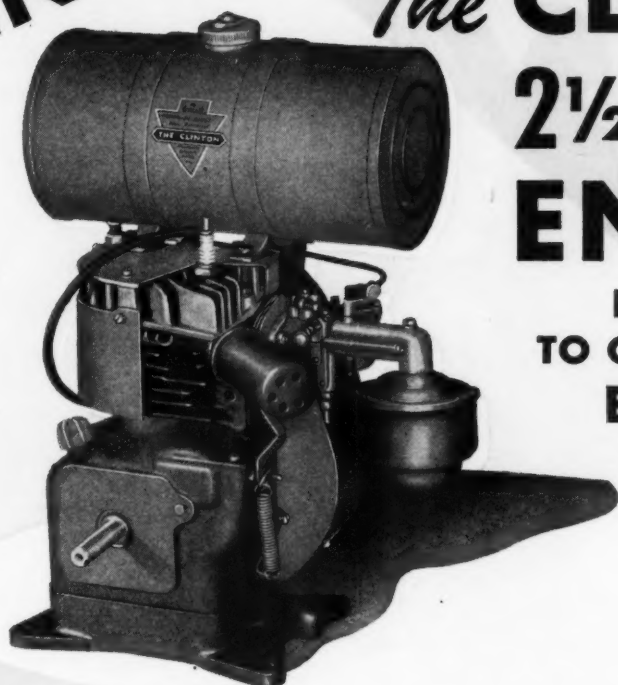
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—for rectangular tanks where horizontal flow is desired. The degree of mixing can be reduced as the sewage flows through the tank by decreasing the number and changing the pitch of the paddles.

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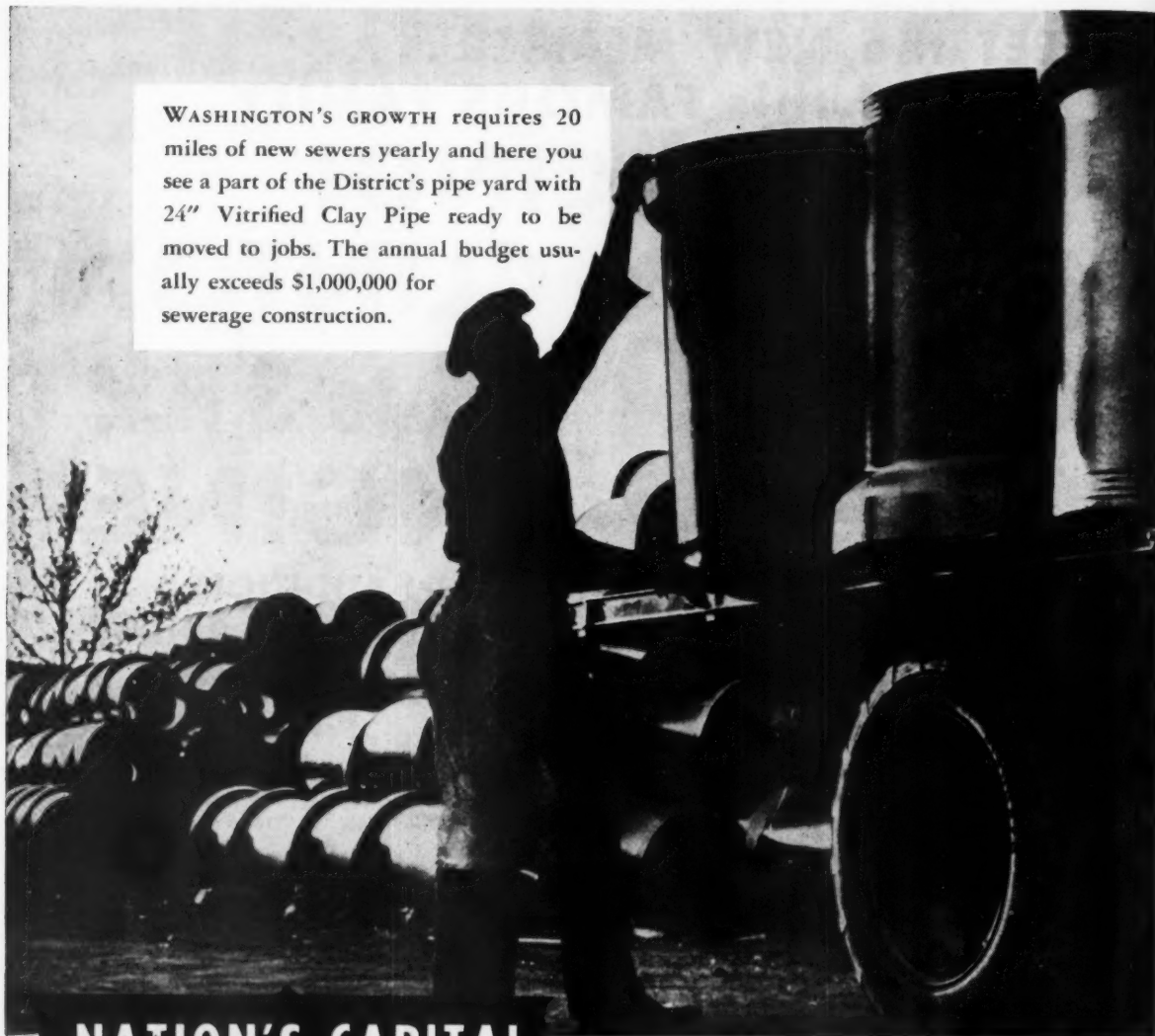
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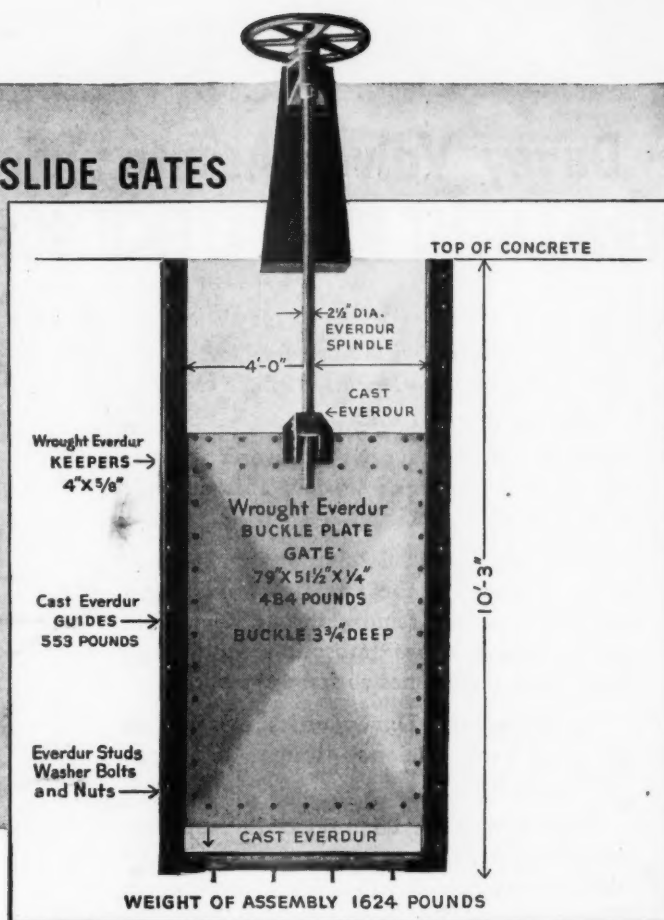
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FROM COTTER PINS TO SLIDE GATES

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STANDS UP
LONGER IN
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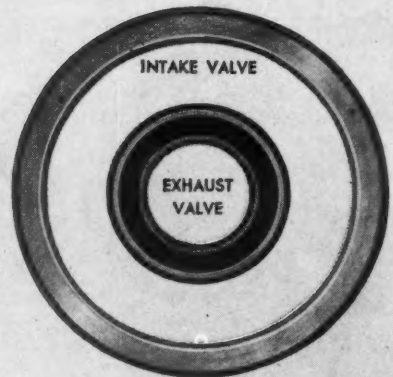
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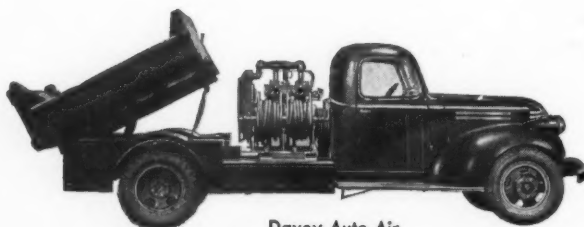
Davey is your best compressor investment—both for today and tomorrow. See your Davey dealer now. Ask him to tell you more about Davey valves—also, how vibration has been "engineered out" of the Davey line for '47.

P & P-115

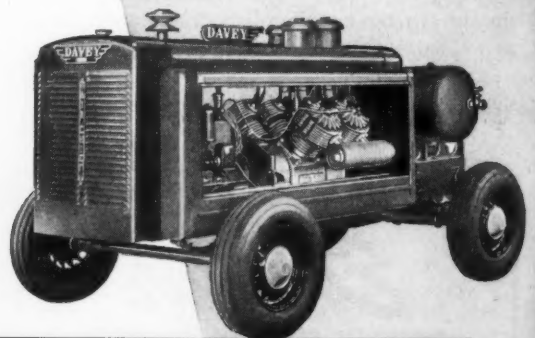


AFTER 13 YEARS of continuous service, these valves were recently removed from a Davey Compressor*. Their peak-efficiency condition is attested by the absence of carbon or pitting. Note how they have obviously seated perfectly—the complete absence of any signs of leakage... after 13 years.

**Owner's name on request.*



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Model 105

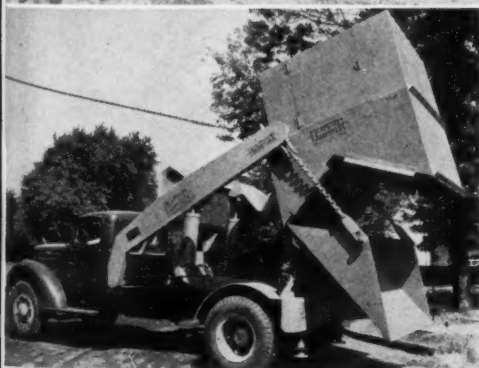
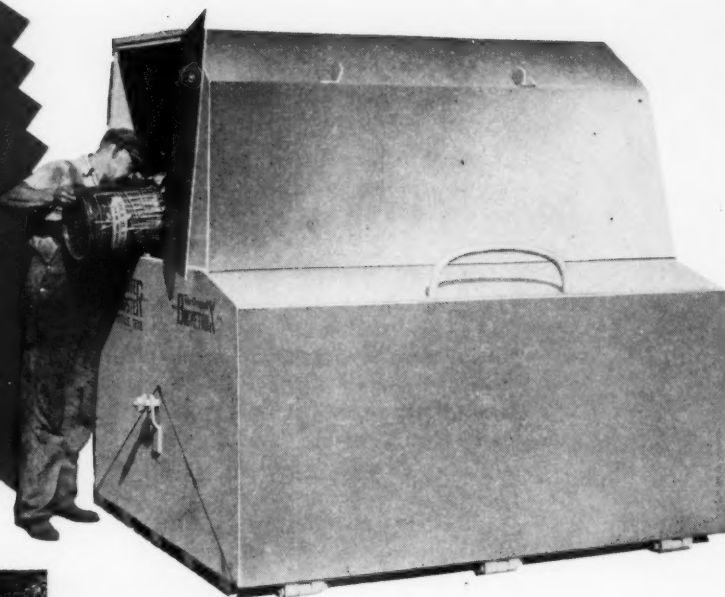


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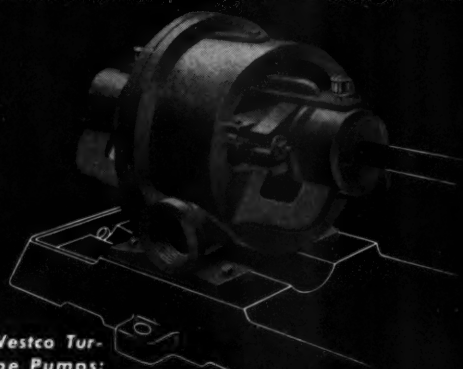
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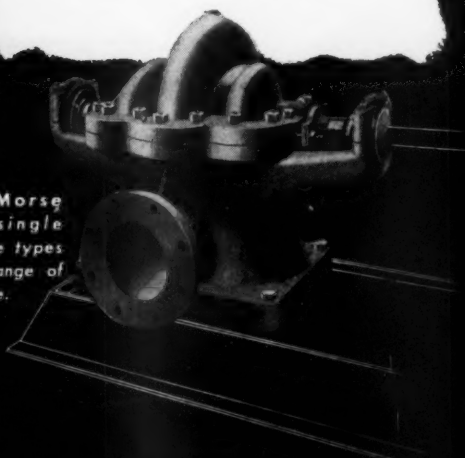
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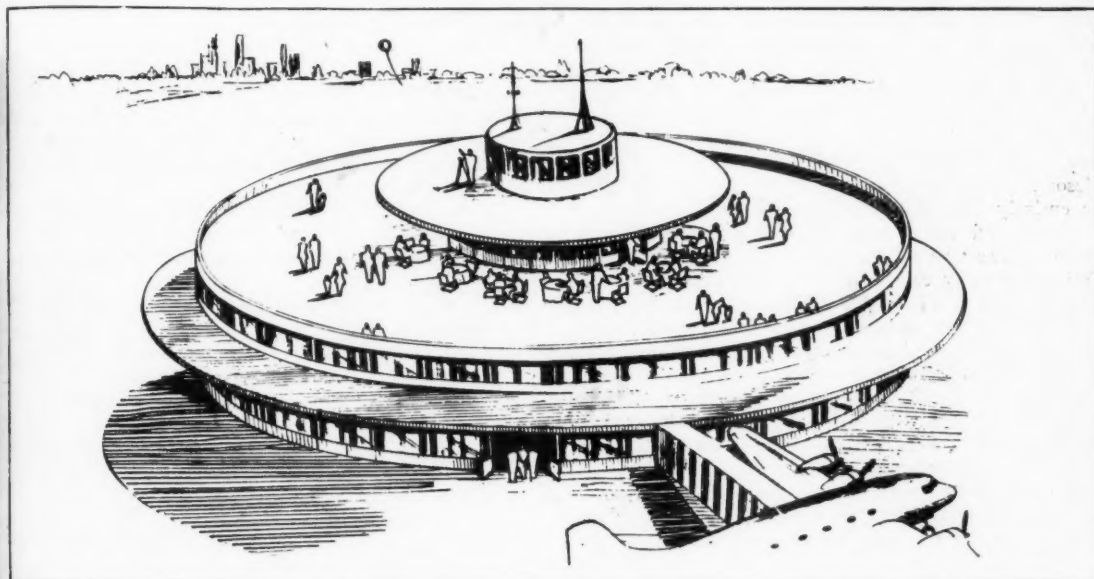


Fig. 2. Artist's conception of an Operations Building for an unidirectional airport.

Rational Airport Planning

The Unidirectional Runway

A proposal for a new, more usable and economical airport design by a man widely known in aircraft manufacturing and air transport fields, who is now applying his aeronautical engineering experience to tailoring airports to fit requirements of the airplane and the airline.

By EDWARD PAYSON HALL

Airport Planning and Design Consultant

FUTURE growth of commercial air transportation is dependent upon an extensive and useful nationwide system of adequate airports. Axiomatically, sound expansion of air transportation must be predicated upon *economically sound* airport development—economically sound from the standpoint of *commercial operation* and economically sound from the standpoint of *airport construction*. A rational approach to airport planning and design indicates that in achieving economy of commercial operation economy of airport construction inevitably follows.

Operating economy can best be achieved by providing runways of adequate length to permit use of flying equipment at maximum allowable gross weight (and payload) and by proper location of runways to allow year around handling of heavy traffic without delay on the ground or in the air. Although these requirements seem elementary, it is a fact that as

of March 15, 1947, 40% of the communities authorized by the Civil Aeronautics Board to receive scheduled air transportation were without airline service because essential facilities were lacking. Further, air carriers have not been able to provide hoped-for increases in scheduled speed because of increased delays at existing inefficiently designed airports. Similarly, technical improvements in ground facilities and weather forecasting have not resulted in improved dependability because of airports that are incapable of handling increased postwar air traffic.

Airport Planning Considerations

Heretofore airports have been laid out with a runway in the direction of the prevailing annual all-velocity winds at the airport site. Examination of wind data of all U. S. Weather Bureau observation stations shows that in different localities wind veloci-

ties from 0 to 15 mph occur 39 to 100% of the time and it is obvious that the prevailing annual all-velocity wind is very strongly influenced by the large proportion of low velocity winds. Low velocity winds are of little concern to the commercial airline, but high velocity winds, those above 15 mph, are of importance and it can be demonstrated clearly that the prevailing high velocity winds are almost always in a different direction from the prevailing all-velocity winds. Since low velocity winds are of little concern to the pilot, it is manifestly incorrect to locate a runway in their direction, completely ignoring the troublesome high velocity winds which are usually from an entirely different direction.

Sound and rational analysis of wind data for a large Midwestern city shows that a single *properly directed* runway could be used by prewar transport aircraft 99.4% of the time throughout a ten-year period without encountering unsafe cross-winds. New postwar transport aircraft could use the same single runway during all but *four hours* out of the entire ten-year period. U. S. Weather Bureau wind data indicates that the wind velocities for this particular city are more diversified as to direction than those to be found in most parts of the country and it is safe to conclude that the vast majority of airports throughout the United States would lend themselves quite as readily to single runway operation.

A Rational Airport Plan

The first development stage for a rational airport plan consists of a single runway of *adequate length* and *properly directed* with due consideration to the existing wind pattern at the airport site. Paved runway length should be 5000 feet with an additional

1000 feet of cleared, level land available at each end. If future expansion is anticipated, additional land should be available by option or purchase as shown in Fig. 1a. Increased safety suggests a runway width of 300 feet rather than 150 to 200 feet commonly used on existing airports.

Personal aircraft can utilize sod runways at angles to the paved runways since all light aircraft require short landing and take-off distances. Successful application of casting landing gear to light planes and increasing use of tricycle landing gear will eventually obviate the use of multiple sod runways even for private aircraft.

The second development stage (Fig. 1b) presupposes increased traffic and the use of larger aircraft. Runway length is increased to 6000 feet and perma-

Unidirectional Airport		Proposed Improved Midwestern Airport	
Total Paved Area (sq. yd.)	Total Land Area (acres)	Paved Area (sq. yd.)	Land Area (acres)
440,000	610	Existing 345,000 New 1,313,000 Total 1,658,000	1454

Fig. 4. A comparison of costs.

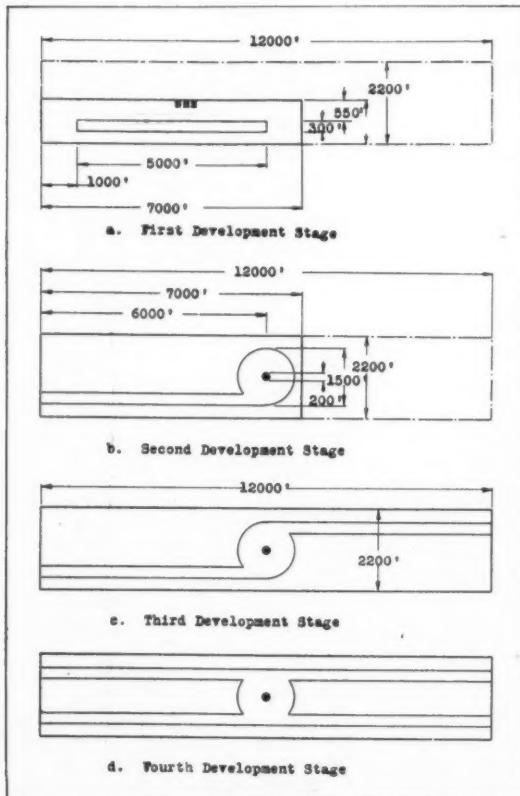


Fig. 1. Airport development stages.

nent facilities are provided for terminal building, post office, servicing, maintenance, restaurant, waiting room, parking space, offices, etc. The circular loading apron should also be constructed since the apron forms an integral part of the permanent facilities. Only the circular concourse surmounted by a restaurant and control tower are located above grade line (Fig. 2).

When traffic volume justifies further expansion, the third development stage (Fig. 1c) provides for the addition of a second runway of 6000 feet parallel to the existing runway and tangent to the circular apron. Incidentally, an airport such as this would be capable of handling more traffic than any airport in operation in the United States today.

Should the community become the terminus for international operations, the two existing runways could be increased to 12,000 feet which would accommodate the largest long range aircraft foreseeable in the future. This would constitute the fourth development stage (Fig. 1d).

Advantages of the Unidirectional Runway Airport

The airport development plan as here proposed is one that can be started at very low cost and expanded, step-by-step, to an airport capable of handling a larger volume of traffic faster and far more economically than any other airport either built or planned. Simultaneous landing and take-off combined with almost zero taxi time (see Fig. 3) materially aid in increasing the speed and dependability of scheduled air transportation.

Proper selection of the airport site is of the utmost importance if the airport is to serve adequately the community for which it is constructed. Time-saving advantages of air travel are frequently lost due to excessive time consumed in going to and from outlying airports. Many more sites closer to population centers are made available for consideration by the markedly reduced land area required for the unidirectional run-

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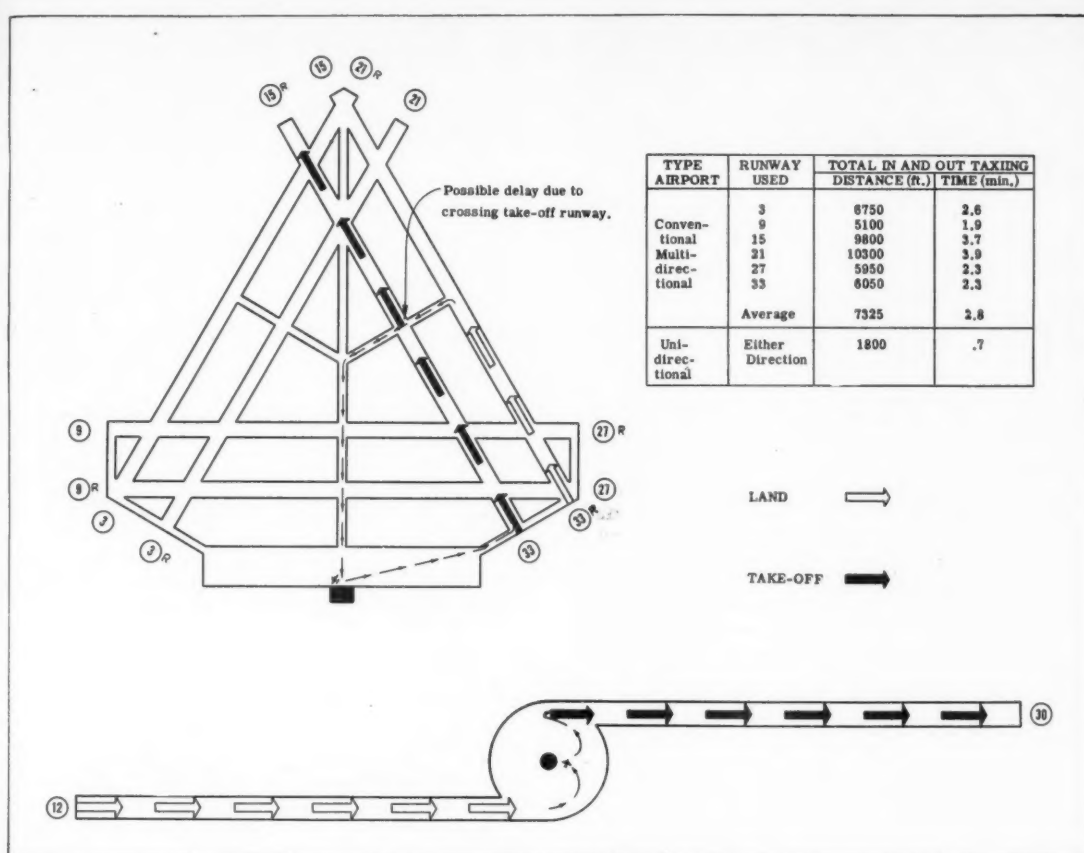


Fig. 3. Comparisons of airport taxiing performance.

way airport despite the need for a long strip of land. Since this master plan requires a narrow strip of land, it is entirely feasible for the airport to be built crossing a highway, the highway underpassing the narrow width of the airport. This factor, combined with the need for much smaller land area, permits selection of a site much nearer and more accessible to population centers than is possible with conventional airports.

Freedom from obstructions is another very important consideration in airport site selection (see "Protecting Your Airport Investment," *Public Works Magazine*, July, 1947). The unidirectional runway airport is obviously superior in this respect since it requires take-off and landing approach zones to be clear in only two directions while the conventional airports usually require not less than six obstacle-free approach zones. Further, with six or more approach zones, it is almost inevitable that at least one of these zones will pass over tall structures in the business or industrial sections of the city. This factor, in itself, generally forces the conventional airport site to be located far distant from residential, commercial and industrial districts. It is also far easier to secure air rights and to pass zoning legislation to prevent subsequent construction of hazardous obstacles for two approach zones than for six.

Elimination of excessive grading expense requires the airport site to be not only reasonably level but also provided with good natural drainage. This requirement will be fulfilled at many more sites by a narrow strip of land than for a rectangular plot,

approaching a square in shape, of about twice the area. Good drainage can obviously be provided more simply from a single runway than from a multiplicity of runways and attendant pocketed areas which require troublesome surface drains.

Lower land and construction costs are illustrated in Fig. 4 which compares the proposed improved airport of a large Midwestern city with the unidirectional runway airport. Introduction of blind landing and fog dissipating equipment will make it a matter of even greater importance that a single runway be available throughout the year since the cost of equipping more than one runway will almost certainly be prohibitive.

Greatly increased safety will result from the use of the unidirectional runway airport due to the greatly simplified traffic pattern and the simplified approach procedure which will permit straight-in approaches under all weather conditions. Most serious landing accidents of the past could have been avoided by use of the proposed airport since there is 6000 feet of land on which to stop after reaching the end of the runway. Overshooting is thus virtually impossible and a much greater margin is available for errors of pilot judgment and technique.

Advantages of the unidirectional runway airport over the conventional airport are summarized below:

1. More possible sites closer to population centers from which to select:
 - a. Smaller land area required (approximately $\frac{1}{2}$ of conventional airport area)

(Continued on page 36)

Performance Data on Tangential Influent Clarifiers

Results of a study carried out by the Texas State Department of Health on the performance of tangential influent clarifiers in municipal sewage treatment installations

By G. R. HERZIK, JR., H. L. DABNEY and R. H. WEISS

Texas State Department of Health

WITHIN the past few years there have been built in Texas two sewage sedimentation basins in which sewage is introduced tangentially at the periphery of a circular tank and is removed by means of central notched circular weir troughs. In the past, due to absence of experience with installations of this type, they were assumed to be capable of producing results similar to other standard settling units; and they were approved, on this basis, as integral parts of plans prepared by consulting engineers. More recently, an increase in the proposed usage of this type, combined with the belief of some consulting engineers that results could be secured that were superior to the average installation, led to the study reported in this article.

In this type of tank, incoming sewage is channeled along the circumference of the basin and downward, by means of a circular metal skirt placed within the tank, near the outside wall, and extending from above the liquid surface to within a short distance of the bottom of the tank. Of the two units described here, one serves as a primary clarifier for the municipal sewerage of Brownwood and the other serves as a final clarifier, following an Imhoff tank and a single stage high-rate filter, for Harris County Water Control and

Improvement District No. 11, otherwise known as Greens Bayou.

The skirt in the Brownwood installation varies in distance from the wall. It is 4.33 ft. from the wall at the point of entrance of the sewage and 1.25 ft. from the wall after it has circled the tank and returned to the point of entry of the sewage. The skirt in the Greens Bayou installation is uniformly spaced 1.5 ft. from the wall of the clarifier.

The accompanying flow and analytical data on the Brownwood plant were obtained from a group of three 24-hour weighted composite samples collected in February, 1947; and four 24-hour weighted composite

Table 3: Brownwood Results

	Raw Sewage, PPM.			Clarifier Effluent, PPM.		
	Aver.	Max.	Min.	Aver.	Max.	Min.
B.O.D.	204	240	140	133	168	110
Total SS	225	284	194	128	170	106
Volatile SS	163	184	136	106	144	86
Fixed SS	62	102	34	21	46	4

The maximum and minimum figures given in this table are individual results secured on any one day and not necessarily on the same day for the various analytical items. They are included primarily to show the range of results obtained.

Table 1: Physical Characteristics of the Plants

	Brownwood	Greens Bayou
Population served	18,000	8,000
Diameter of clarifier, ft.	56.5	45
Volume in gallons	227,048	105,150
Surface area, sq. ft.	2,507	1,590
Sidewater depth, ft.	11.33	8.37
Weir length, ft.	175.9	125.6
Central depth, ft.	13.67	9.90
Depth of skirt, ft.	10.0	6.53
Weir trough width, ft.	1.16	2.0

The volume as given above includes that due to the sloping bottoms. Weir length is the projected length. Surface area does not include weir area. Weir trough feet is computed from average diameter and weir width.

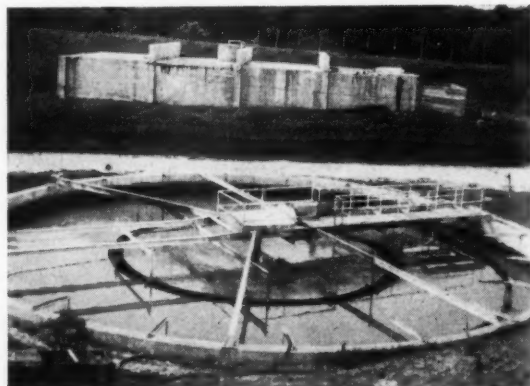
Table 2: Flow Characteristics

	Brownwood	Greens Bayou
Flow, Average MGD		
Average	1.095	0.920
Maximum	1.143	.959
Minimum .....	.990	.895
Detention Period, Hours		
Average Flow	4.97	2.73
Maximum Flow	4.77	2.62
Minimum Flow	5.51	2.81
Surface Loadings, Gals/Sq. Ft./Day		
Average	437	578
Maximum	456	602
Minimum	395	563

All data for the Greens Bayou plant include 30,000 gallons per hour or 0.72 mgd. recirculation.

Table 4: Brownwood Removals, Per Cent

	BOD	Total SS	Volatile SS	Fixed SS
February 18	42.0%	42.8%	33.8%	63.3%
February 19	46.5	41.6	46.9	28.1
February 20	24.2	23.4	7.7	60.6
March 10	32.6	43.7	40.8	54.5
March 11	40.5	42.4	32.5	88.3
March 12	30.0	43.4	31.5	78.2
March 13	21.4	62.6	50.5	84.4
Average	33.9%	42.9%	34.8%	65.4%

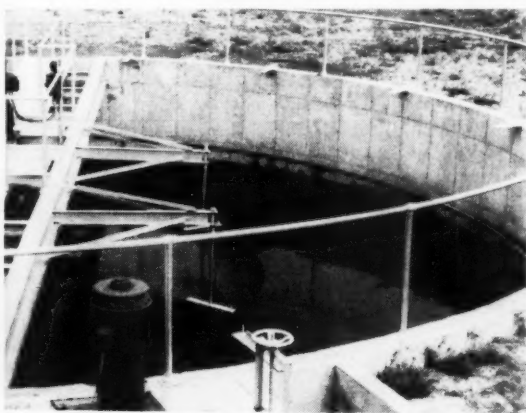


The Brownwood clarifier.

samples collected in March, 1947. Rain occurred during the entire February sampling period and also during the first three days of the March sampling period. The samples were taken under the direction of J. M. Dougherty, Assistant Engineer of the State Health Department, and were analyzed in the Texas State Health Department Laboratory.

From a review of the data contained in Tables 3 and 4, it is shown that there was obtained an average BOD removal of 33.9%, with a maximum in any one sampling day of 46.5% and a minimum of 21.4%. Total suspended solids removals averaged 42.9%, with a day's maximum of 62.6% and a minimum of 23.4%. Volatile suspended solids removals averaged 34.8%, with a daily maxima of 50.5% and minima of 7.7%. Fixed suspended solids removal averaged 65.4%, with maxima of 88.3% and minima of 28.1%.

Another form of reporting these data is as follows: The average content of the raw sewage showed 1862 pounds of BOD; the effluent showed 1219 pounds. Total suspended solids averaged 2066 pounds in the raw sewage and 1161 pounds in the effluent. Volatile suspended solids averaged 1498 pounds in the raw



View of the Greens Bayou clarifier.

sewage and 969 pounds in the tank effluent. Fixed suspended solids in the raw sewage averaged 561 pounds, and in the effluent 191 pounds. These were the average loads, but there were, of course, deviations above and below these averages, as shown in the table.

Greens Bayou Final Clarifier

The accompanying flow and analytical data for the Greens Bayou plant were obtained from a group of three samples, which includes a 24-hour weighted com-

Table 5: Greens Bayou Results

	24-hour Composite	12-hour Composite	Staggered Grab
Flow, Raw Sewage MGD....	0.239	0.187	0.175
Filtered Sewage PPM			
BOD	23	21	19
TSS	62	..	..
VSS	36	..	..
FSS	26	..	..
Clarifier Effluent PPM			
BOD	16	19	16
TSS	42	..	..
VSS	20	..	..
FSS	22	..	..
Per Cent Removals			
BOD	30.4	9.4	16
TSS	32.4	..	..
VSS	44.2	..	..
FSS	15.5	..	..



Greens Bayou peripheral skirt.

posite sample taken in April, 1946; a 12-hour daytime weighted composite sample taken in June, 1946; and a one-day series of staggered grab samples taken, in June, 1946, from the various units at intervals suggested by the theoretical detention periods of the various units.

These samples were taken under the direction of former Texas State Health Department District Engineer Frank J. Metyko and analyzed by Edwin B. Hibbs, Stream Pollution Chemist of the Texas State Department of Health, in one of the Mobile Laboratories of the Bureau of Sanitary Engineering. From a review of the data shown by them, BOD removals through the clarifier average 30.4% for the 24-hour composite; 9.4% for the 12-hour composite; and 16.0% for the staggered grab samples with consideration being given to approximate detention periods through the plant units. The average suspended solids removal was 32.4%; fixed suspended solids 15.5%; and volatile suspended solids 44.2%, based on the 24-hour composite sample.

Stating it in another form and basing calculations on recirculation of 720,000 gpd. from the clarifier to the Imhoff effluent, the BOD load applied to the clarifier was 183.8 pounds, based on the 24-hour composite; and the BOD in the clarifier effluent discharged from the plant amounted to 31.9 pounds. The 12-hour composite showed 158.5 pounds loading and 29.6 pounds in the effluent. The grab samples showed 142 pounds loading and 23.3 pounds in the effluent. Total suspended solids applied to the clarifier amounted to 495.5 pounds, with 83.6 pounds remaining in the effluent (on the 24-hour composite basis). Fixed suspended solids were 207.8 and 43.8 pounds, respectively; and volatile suspended solids, 287.7 and 39.9 pounds. These are the loadings on the clarifier, including recirculation, and the plant effluent content minus that recirculation.

The Greens Bayou treatment plant has an overall BOD removal of 93%. Of this removal, 71% is accomplished in the Imhoff tanks, 9.7% in passing through the filter, and 12.3% in the final clarifier.

Water-Borne Disease Outbreaks

A summary of reported water-borne disease outbreaks in the United States, 1938 to 1945, with classification of outbreaks by causes.

DISEASE outbreaks caused by impure water have been numerous and, in the 8 years covered by the data in this article, accounted for probably more than 114,000 cases of sickness, and for at least 84 deaths. In 1938, there were 47 such outbreaks recorded; in 1939, 42; in 1940, 42; in 1941, 58; in 1942, 52; in 1943, 23; in 1944, 32 and in 1945, 20. This is a total of 316 outbreaks. Of these 313 could be broken down to indicate the general method by which the water was polluted, and 285 could be grouped by size of community.

These data are presented in detail in a report of the hearings on S 418, a bill to provide for water pollution control by the U. S. Public Health Service, and the data are from the files of the Public Health Service which, since 1938, has collected data on disease outbreaks caused by water. Previous to 1938, this subject was covered, for the period 1920 to 1929, by the excellent book by Wolman and Gorman "The Significance of Water-Borne Typhoid Fever Outbreaks"; and in subsequently published material for the years 1930 to 1936. The current

data are of especial interest as reflecting what happened to water supplies in the trying years of the war.

In addition to the 316 outbreaks for which data are given here, 10 outbreaks were reported where the evidence was not conclusive that the water supply was implicated. These cases, which have been omitted from the accompanying tabulations, involved about 245 cases of disease.

The data presented by the Public Health Service, and printed in the report of the hearings, entitled "Stream Pollution Control," covers 44 pages of tables and notes, and are printed in very small type. The tables show for each outbreak and for each year separately, the following information: The disease and organism involved; the state and community where the outbreak occurred; the population of the community; the total number of cases in the community; the cases investigated; the population exposed; the number of deaths; the date of onset of the first and final cases; the method of contamination; the type of water supply; and the kind of treatment, if any. In addition, there are voluminous

By number of outbreaks, surface pollution of shallow wells retained its primacy in disease outbreaks. By number of cases, surface pollution of wells was eclipsed by three other factors: cross-connections and other defects in the distribution system; failure in the water purification process; and use of untreated polluted water. The total cases represented here equal the number reported during the entire period, 1920 to 1936.

notes presenting detailed epidemiological information on nearly every outbreak.

Classifying the Data

In preparing the data herein, the same classification was used as in the 1930-36 data, with a few minor variations, thus permitting a comparison to be made of the relative importance of the different elements entering into these later outbreaks. In a number of cases, there were two or more factors which appeared to share the responsibility. Where water treatment was provided and this appeared to be implicated because of failure to perform properly, the outbreak was generally charged to a defect in the purification procedures. This policy was followed because the function of a water treatment plant is to so treat water that may be unsafe as to make it safe. In classifying a considerable number of the items, there was some latitude for judgment; therefore classification by another may not agree precisely with the data presented here.

It is of interest to compare the 1930-1936 data with those included in this tabulation. Despite the greatly increased number of outbreaks, and the still greater increase in total persons affected, the number of cases of typhoid was reduced by more than 40% on an annual basis, or from 3,180 for seven years to 2,047 for 8 years. In this connection, it will be noted that only 84 deaths were reported as due to these outbreaks in the 1938-1945 data. This is much below the expectancy of death for the number of typhoid cases reported.

Population	Number of Outbreaks	Percent of Outbreaks	Population Affected
1,000 and under	67	23.5	2,453
1,001 to 4,999	111	39.0	11,227
5,000 to 9,999	54	19.0	8,295
10,000 to 24,999	16	5.6	6,282
25,000 to 49,999	12	4.2	10,329
50,000 to 99,999	3	1.0	240
100,000 to 499,999	13	4.6	39,527
500,000 to 999,999	6	2.1	29,750
Over 1,000,000	3	1.0	450
	285	100.0	108,553

Outbreaks of water-borne disease, 1938 to 1945, classified as to population groups affected, with number of cases in each group.

Cross-Connections

The predictions made in 1941 and 1942 that our greatly increased industrial production tempo would result in an increase in disease outbreaks due to cross-connections appear to have been borne out. There were 30 outbreaks reported due to this cause, a number of which involved ships. The total cases of illness aggregated 46,497, which compares with 14 outbreaks and 2,118 cases of sickness for the 1930-1936 period. Though a small part of this increase might be due to a greater awareness of the possibilities of danger from this source, and a more thorough exploration of the cause of the outbreak, there seems to be no doubt that the prediction was based on sound premises. The intensive program for the elimination of cross-connections which was carried on by the Army Sanitary Engineering Division and the Public Health Service, largely as a cooperative project with the various State Sanitary Engineering Divisions, without doubt had a considerable effect in controlling this particular channel of spread of disease. This is the more likely since one outbreak alone was responsible for 35,000 of the cases, and the total of the remainder, while considerable is not less than might normally be expected under the circumstances.

Inadequate control of filtration and allied treatment processes accounted for 12,770 cases; and inadequate or interrupted chlorination, where chlorination was the only treatment, was responsible for 29 outbreaks and 13,346 cases. It is not believed that the wartime shortage of chlorine was in the least responsible for any of these 29 outbreaks; generally, it was carelessness, ignorance or reluctance to face possible complaints of taste or odor, but it may also have been due to the heavily personnel turnover resulting from the war and the necessity for utilizing men not particularly skilled in this field.

Well and Spring Supplies

About half of the outbreaks, 148 of them, in fact, originated in well and spring supplies, resulting in a total of 7,588 cases of disease. This compares with 64 outbreaks and 3,188 cases in the 1930-1936 period. Many of the outbreaks reported in this article resulted from the use of shallow, improperly protected wells, often located close to or downhill from a toilet or cesspool. While sufficient data are perhaps lacking upon which to base a categorical statement, the compiler remembers no case involving well-constructed and properly located pit toilets; and believes there were exceedingly few, if any, where wells which were likewise properly constructed and located were involved. The large number of disease outbreaks in this classification points to the great need for plenty of every-day sound sanitation.

Classification As to Cause	Outbreaks Reported	Cases of Typhoid and Paratyphoid	Cases of GI, Dysentery & Diarrhea	Total Persons Affected
A. Surface Water Supplies:				
1. Contamination of brook or stream from pollution on watershed.	9	142	410	552
2. Use of polluted water from stream or irrigation ditch, untreated.	14	79	601	680
3. Use of polluted lake water, untreated.	7	15	29,288	29,303
4. Contamination of spring or infiltration gallery by pollution on watershed.	3	47	16	63
5. Contamination of spring or infiltration gallery by flood waters. . . . .	...	...	...	...
B. Underground Water Supplies:				
1. Surface pollution of shallow wells.	13	77	140	217
2. Faulty well casing or construction.	9	13	254	267
3. Pollution of well from adjacent river or lake.	7	20	447	467
4. Pollution of well from adjacent sewer or sewage tank.	28	135	1,132	1,267
5. Underground pollution of well or spring in creviced limestone or fissured rock.	17	248	745	993
6. Underground pollution of well or spring, source unknown.	51	173	1,752	1,925
7. Underground pollution of well by surface contamination.	21	126	1,026	1,152
8. Overflow of sewer or flood water into top of well casing.	2	...	1,300	1,300
C. Reservoir or Cistern Storage:				
1. Seepage from sewer or surface into cracked cistern or reservoir.	1	500	...	500
2. Reservoir polluted by flood waters.	1	4	...	4
D. Water Purification:				
1. Inadequate control of filtration and allied treatment.	7	...	12,770	12,770
2. Inadequate chlorination, only treatment.	21	183	6,828	7,011
3. Interruption of chlorination, only treatment.	8	25	6,310	6,335
F. Distribution System:				
1. Pollution of water mains during construction or repair.	6	...	1,022	1,022
2. Leaking water main and sewer in same trench.	1	...	40	40
3. Cross-connection or back-siphonage.	30	20	46,477	46,497
4. Break in mains permitting sewage or polluted water to enter.	3	10	290	300
5. Pump pit polluted by leaky sewer.	2	..	266	266
G. Collection or Conduit System:				
1. Auxiliary intake to polluted source. . . . .	...	...	...	...
2. Seepage of surface water into tank or cistern.	1	...	13	13
H. Miscellaneous:				
1. Use of polluted supply because of objectionable taste or odor of public supply.	2	2	35	37
2. Use of polluted water not intended for drinking.	4	20	247	267
3. Cause of outbreak undetermined.	23	82	2,074	2,156
4. Insufficient information for classification.	17	91	621	712
5. Swimming in polluted water.	1	35	...	35
6. Toxic material in water.	3	...	134	134
7. Polluted Ice.	1	...	7	7
	313	2,047	114,245	116,292

Water-borne disease outbreaks in the United States, 1938 to 1945, with classification as to outbreaks and number of cases.

These same underground water supplies were responsible for the greatest number of typhoid cases, 792 of the total of 2,047. Most of these were, of course, untreated supplies of the crudest type. In this respect, the later data agree with the 1930-1936 figures, which show, however, only 170 cases of typhoid. Thus, inadequate wells and unprotected springs remain one of the most important sources of serious water-borne disease.

Under the heading A-3, "Use of Polluted Lake Water, Untreated" is included one outbreak causing 29,250 cases of gastroenteritis. This resulted from "by-passing the sewage plant" and "using polluted lake water." The full report covering this outbreak is not presently available to the compiler,

and it is possible that the classification may be incorrect.

Size of the community did not guarantee freedom from water-borne disease. Table II shows that residents of communities of all sizes suffered, even those of our largest city, though relatively mildly in this case. It was possible to classify 285 of the 316 outbreaks, and 109,553 cases, by size of community. It is likely that the remaining 31 outbreaks were in wholly rural areas or extremely small communities.

It has been noted with some satisfaction that only one of these reported outbreaks occurred at an Army installation, and that this was due to a temporary and isolated condition and not to the post water supply quality.

California's Freeway Design and Construction

A freeway in San Diego is facilitated by advance planning over a period of years; soil-cement and asphaltic base with concrete surface; construction details and methods.

By EARL E. SORENSON

District Construction Engineer

IN the geographic center of San Diego is Balboa Park, with an area of 1400 acres, a large portion of which is still in a semi-primitive stage. Cabrillo Canyon and Powderhouse Canyon extend the full length of the park, running generally north and south, with numerous short arroyos branching out at right angles. This natural terrain is peculiarly adapted to the economical construction of a freeway, for the arroyos, with short structures for cross traffic, form a natural distribution system to all parts of the city. The freeway has been in contemplation by the California Division of Highways for a number of years and all improvements made in the past have been designed to fit into the final plan, now nearing completion.

The only existing structure which could be utilized in the ultimate plan was the historic Cabrillo Arch Bridge on Laurel Street, built for the 1916 Exposi-

tion. This bridge now forms the main cross-town artery. The freeway project involved the construction of 15 additional bridges. The first bridge forming a part of the long range plan, was constructed across Washington Street at Sixth Street in 1940, and the final structures at the Mission Valley interchange will be completed this year.

A special feature of the program, which is believed to be unique, is the provision for equestrian traffic. Balboa Park canyons and timbered hillsides form a natural setting for the bridle paths, which are used yearly by thousands of horseback riding enthusiasts. The Date Street Bridge provides a separate "fenced-in" lane for horses only. From here, the trail meanders over the hills of the West Park and again crosses the Freeway over the Upas Street equestrian overpass built exclusively for equestrians and pedestrians and giving access to many miles of trails in the East Park.

A Million and a Half Yards of Earth Moving

The major portion of the earth moving, involving in excess of 1,500,000 cu. yds. was handled by tractors and scrapers. Basich Bros., contractors, employed scrapers of up to 32-yd. capacity on the northerly unit and in some cases moved earth a distance of 4000 feet economically by this method.

Water trucks of 5000 gals. capacity were used to supply water for compaction on the north unit, while a pipe line was used from University Ave. south. Both methods were successful and both were well adapted to the conditions where used. In both cases, water was introduced into the earth immediately following scarifying and prior to loading into the scrapers. This method resulted in better distribution and more uniform water content and also facilitated loading.

A sprinkling system, to water the planting from Washington Street south, was installed. The extent of this planting is indicated by the fact that 4-in. main supply lines are needed to supply sufficient water to the numerous sprinklers and risers. It is anticipated that the planting will be completed and well propagated by the end of the year.

The separation structures are completed with the exception of the two forming a part of the Mission Valley interchange. Scarcity of some critical materials has been responsible for retarded progress, but it is expected that this situation will be remedied quickly. The location of the structures are shown in the accompanying aerial photograph. Another illustration shows the Mission Valley interchange bridges under construction and also the progress on other phases of the work at this location.



Concrete paving operations, showing form placing and concrete pouring.



The Cabrillo Freeway, looking north across Mission Valley Interchange.

Constructing the Base

A central mixing plant for introducing cement into selected material to form the 4-inch cement stabilized base, was constructed on the north end of the job. The plant, consisting of crushing and screening units and a Barber-Greene mixing plant, has a capacity of 100 cu. yds. per hour. The selected material, obtained from a highway cut at the north end of the project, gave excellent results, showing a strength of up to 500 pounds per square inch at 7 days, using 4% cement and 12% moisture. The base course was placed using a Barber-Greene spreader with the strike-off screed controlled by a wheel attachment riding the side forms. No subsequent cutting or shaping was necessary and the emulsified asphalt seal was placed directly after the rolling and compacting had been completed. This stabilized base course was laid on 8-inches of selected material or imported borrow, forming the support for an eight-inch slab of concrete.

Pouring the Concrete Slab

Pouring of the concrete slab is nearly complete from Mission Valley to North City Limits. Aggregate is being produced from Mission Valley pits and batched to the mixer through bunkers and automatic scales. Bulk cement is being used, which is placed in the aggregate at the batching plant after being weighed by electrically controlled scales. The mixing is done on the grade by a 1½-yd. Multi-Foote mixer. After depositing the concrete on the grade, it is spread by a Jaeger screw spreader, tamped by a Lakewood tamper and finished by a Johnson power float. An innovation in edge consolidation has been worked out by operating two conventional vibrators through a power take-off from the engine on the Jaeger spreader. Excellent results in densifying the concrete along the headers is being obtained. Curing is by means of an earth and water blanket.

The number of side forms required to place both stabilized base and concrete pavement in a continuous operation, in the volume planned by the contractor, was so large that it was uneconomical and impractical to obtain them. The center dividing curbs and gutters were therefore placed prior to stabilization and paving. The subgrade shaper, cement stabilized base spreader, and concrete equipment are operated with the gutter supporting and gauging the one edge. This reduces the side forms required for each lane to one line and permits the contractor to extend his operations over a sufficient distance to allow the various operations to continue smoothly without overlapping or delay. This method also eliminates objectionable lateral movement or rocking of the side forms due to lateral stresses, set up by the spreader screw and also by the walking beams of the finisher.

In order to expedite the work and to operate more economically on paving operations, Basich Bros. Construction Company and Mittry Bros. entered into a joint agreement for handling the stabilizing and paving operations on the two adjoining contracts and this work will be accomplished without change in equipment or crews. This arrangement will also permit a wider selection of operating areas so that pavement can be placed, without intervening shut-downs, at locations as quickly as they become available. Rapid progress has been made, with an average production of 650 cu. yds. of concrete per shift.

The intimate and overlapping nature of the construction operations on this series of projects and the fact that as many as six separate contracts have been carried on simultaneously has made necessary careful correlation of the work and very close co-operation between contractors. In view of this condition, as well as difficulties in securing materials and labor, the progress has been very gratifying and no appreciable overruns in the various completion dates are anticipated.

Research in

STREAM POLLUTION

A resume of some of the research problems affecting stream pollution and field life that are being carried on by the National Council for Stream Improvement was presented recently by Russell L. Winget, Executive Secretary of the Council. He stated that the two important causes of the development of conditions inimical to fish life are: first, the reduction of dissolved oxygen in a stream due to introduction of wastes having a high BOD; and second, the introduction of toxic substances.

Research Projects Under Way

Wastes from certain types of pulp mills have high BOD contents. The problem here is to find some reasonably economic method of satisfying the oxygen demand before the waste is discharged. One method is the use of the trickling filter. A five-year series of researches on the use of the filter in treating waste sulphite liquor was carried on at the Institute of Paper Chemistry in Wisconsin at an expense of some \$50,000. This research progressed from the laboratory stages to a large scale pilot plant at a Wisconsin pulp mill. It was found that considerable reduction in BOD could be obtained but that at present efficiencies, cost of construction for a filter to handle the entire effluent from a mill would approach the cost of the mill itself. At present, attention is being given to increasing the efficiencies of the device so it may be practically employed.

At Oregon State College the possibility of producing fodder yeast from waste sulphite liquor was investigated as it was known that by using the sugars in the wastes to produce yeast, a considerable reduction in the oxygen demand of the wastes could be expected. A plant to produce yeast from waste liquor is now under construction in the Middle West, and it seems that this process holds out some promise. Research is continuing at Oregon State College and the problem undoubtedly will be to produce yeast at a price that will compete with yeast produced from other materials. At Rutgers University laboratory research is being conducted to determine the feasibility of reducing oxygen demand of wastes by the foam phase treatment; and in Michigan, in cooperation with the University of Michigan and Kalamazoo College, a large scale pilot plant to investigate the possibility of reducing the oxygen demand of waste liquors by aerobic decomposition is in operation.

A New Method of Attack

These treatment methods are admittedly in a development stage and are not as yet ready for application except to a limited degree. Pending their further development it has been necessary in emergency situations to apply available methods to existing pollution even though in some cases they may not be either permanent or economic solutions to the problems involved. In this connection the problem of oxygen depletion has been attacked in a new and novel manner in

Wisconsin. Here, with the cooperation of the Wisconsin State Department of Health, the artificial re-oxygenation of rivers subject to pulp mill pollution is being tried. This process consists of diffusing large quantities of air through diffusers installed in the bed of the river below the mill outfall. This restores the oxygen which may have been depleted by reaction to the mill wastes.

Retention Lagoons

Another device which has been employed in emergency problems is the retention lagoon. Originally lagoons were used to provide retention of wastes either permanently or during periods of low river flow. Recently, however, sanitary engineers have developed methods whereby, under certain conditions, with microbiological methods, the pollutional effects of the stored wastes can be greatly reduced and in some cases eliminated. This method has been used with great success by a pulp and paper mill located on the Angelina River in Texas where extremely low summer flows presented a major problem.

In connection with toxicity problems, an aquatic biology project is maintained at the Institute of Paper Chemistry under the direction of Dr. Willis Van Horn, Biologist. Originally the project was set up to determine just what the toxic effects of pulp mill wastes were on species of fish native to Wisconsin. This phase of the work was accomplished by segregating live fish in tanks under controlled conditions, subjecting them to various concentrations of mill wastes and observing the results. Following this, the same procedure was followed with typical fish food organisms. Later, the work was amplified to include analyses of mill sewers for the purpose of developing methods for detecting toxic constituents in the mill waste and the development of automatic electronic warning devices to indicate the presence of toxic compounds in dangerous concentrations.

Other Problems

In 1947 an aquatic biology program was instituted at Oregon State College under Professor R. E. Dimick, Head of Fish and Game Management. It was felt advisable to undertake this work in the Pacific Northwest as in this region there is a heavy concentration of pulp and paper mills, and here, too, commercial fishing on the Columbia River and elsewhere is an important industry. The work here will be somewhat similar to that at the Institute of Paper Chemistry with special consideration being given to the different conditions existing in this area. Of chief importance among the different conditions existing in the Pacific Northwest are the tremendous flows in the great rivers of this area which makes the development of dangerous toxic levels unlikely. During this summer a large and very important phase of the work is being carried on at the College's Marine Laboratory at Yaquina Bay.

Hearne's Municipal Utilities Show a Profit

How a Texas city has developed a system of public utilities that not only makes for better living but also pays most of its running expenses.

By **NORMAN L. MCCARVER**
City Manager

Hearne has just completed its 36th year of successful operation of municipally owned electric, water, and sanitary sewerage systems and has realized a profit of \$61,000. Incorporated in 1871, Hearne has grown from a small railroad station to its present population of 6500, and now presents a pleasant scene of paved streets, a complete whiteway lighting system, a 93-acre municipal park, a municipally owned utility system valued at a half million dollars, and all of the things that go to make up a good place to live.

One of the principal reasons that Hearne has been able to go forward and grow is the fact that the city does not depend upon taxation to finance its government and improvements. The operation of its utility systems produces enough profits to finance the entire expense of the city.

Hearne's venture into the utility business from a municipal standpoint dates back to the year 1911 when the citizens became interested in constructing a municipally owned water system. A bond issue of \$20,000 bearing 5% interest was sold to finance the project, and in 1912, while the water system was being constructed, the citizens decided to add \$5,000 more to the debt and build a municipal power plant also. The original power plant equipment

consisted of one 101-hp. Brownell steam engine with a 75-kw. generator and one 150 hp. steam boiler. Night service only was furnished and every means was taken by the citizens to conserve electricity in order not to overload the plant. In fact, the City Council took steps to make it unlawful for street lights to burn on "moon-light nights."

Power Plant Operation Profits

An operation profit was realized from the power plant from the very beginning, and after \$15,000 of the original investment of \$25,000 was paid by taxation, the plant's earning capacity increased enough to absorb the remaining \$10,000 from operation profits. However, the rates for electric service in the early days were exceedingly high, 15¢ per kwh. straight being the standard charge.

In 1920, a 120-hp. Skinner Uniflow steam engine was installed and in 1924 a 250-hp. Ball steam engine was added. This equipment cared for the demand until 1928, which was the beginning of Hearne's face lifting. A continually growing demand for more service confronted the management and the city council decided to revamp the entire power plant. The plant building was remodeled, and a complete change-over from steam power to diesel power was



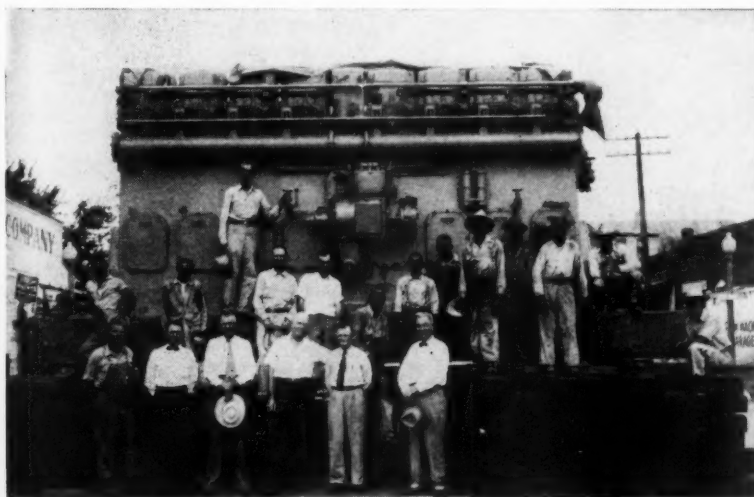
The elevated water tank.

made. At this time, three 180-hp. Fairbanks, Morse diesel engines were installed, and with these additions, city officials were of the opinion that our electric needs could be met for a period of at least twenty years. With the advent of electrical refrigeration, air conditioning, neon lighting equipment and other modern electrical devices, the demand for electric service in Hearne continued, and in 1931 an additional Fairbanks, Morse, 420-hp. 6-cylinder diesel unit was purchased and installed. The plant's capacity now totaled 960 hp., with a generating capacity of 642 kw. From 1928 to 1931, over \$105,000 was spent in changing the plant from steam power to diesel power, and this entire amount was fully paid off in a period of five years entirely from plant earnings.

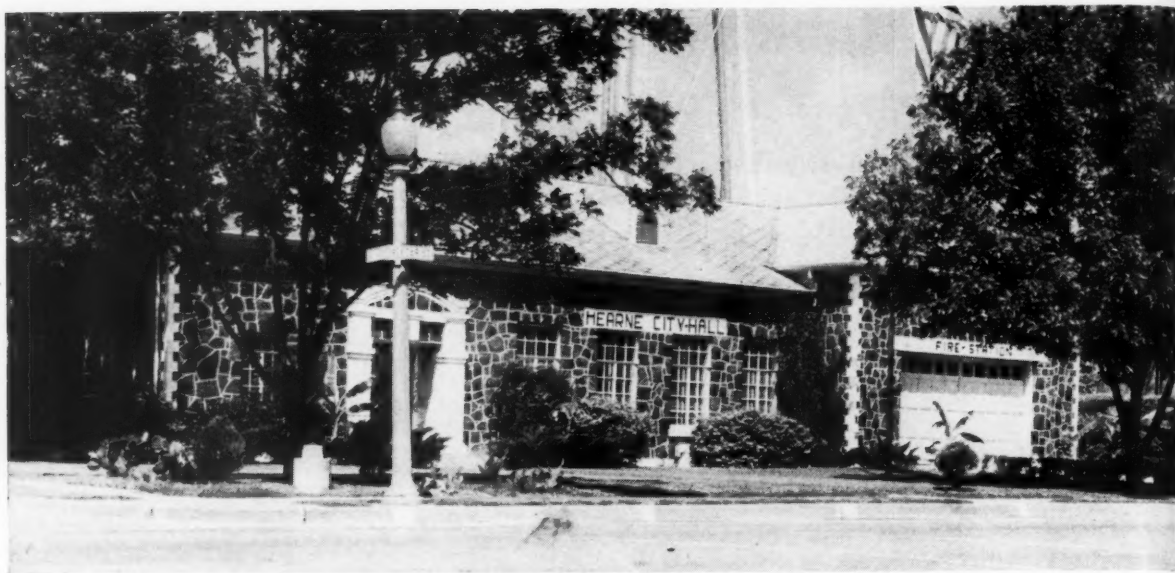
Improving the Water Works

In 1935, Hearne's original artesian water well was still supplying the citizens with an abundance of pure artesian water, but the water level was 21 feet below the surface, and this caused some anxiety on the part of city officials in regard to the dependability of the future water supply. Plans were formulated whereby a 10-inch well, 1277 ft. in depth was drilled, and a new water storage tank of 150,000 gallons capacity was erected, giving a total water storage capacity of 270,000 gallons. These waterworks improvements were financed through a \$20,000 revenue bond issue, paid entirely from the plant's earnings. In addition to improving the water service, this improvement reduced the fire insurance key rate. This \$20,000 revenue bond issue was set up to be retired in 10 years, but was paid out in 5 years.

A steady increase in demand for commercial and residential electric service continued and by the summer of 1939, city officials could vision a shortage in electrical generating equipment. In the summer of 1940 a new 1000-hp. Fairbanks, Morse diesel engine powering a 700-kw. generator was purchased and installed. The entire power plant was remodeled, enlarged, and



1,000-hp. dual-fuel Cooper-Bessemer engine being installed.



The City Hall at Hearne—an example of good governmental planning.

improved at a cost of \$60,000 for the new engine and equipment; \$14,000 for building improvements; and \$3,000 for switchboard equipment; and \$11,000 was spent for a new city hall building. The total expenditure of \$88,000 for all of these improvements and additions was financed through a revenue bond issue, payable out of the earnings of the municipal plant.

During the present year, the City of Hearne has purchased and installed a 1000-hp. Cooper-Bessemer dual fuel diesel engine equipped with a 700-kw. generator which gives our present plant a total of 2960 hp. This dual fuel engine has been found to be very economical in its operation having produced 1,578,100 kwh. on 18,665,000 cu. ft. of natural gas and 30,414 gallons of fuel oil. Our experience has been that this unit consumes approximately 87% gas and 13% fuel oil. The lubrication costs of this unit are also very nominal. Along with the installation of this Cooper-Bessemer unit, the power plant building was again enlarged, the total expenditure amounting to \$75,000, which was paid for in cash.

Our present utility system is now valued at over a half million dollars, and with the exception of the original investment of \$15,000, this valuation has been built entirely on the plant's earnings.

Hearne has experienced a rapid growth in the past ten years, and we have financed all of our civic improvements with earnings from our municipally owned utilities. Construction has been completed on a 93-acre municipal park, embracing a nine-hole golf course with grass greens; a swimming pool 50 ft. by 150 ft.; a native rock bath house 21 ft. by 90 ft.; a community club house with auditorium, dining room, kitchen, ladies' and

men's lounges, and locker rooms; children's playgrounds; and picnic grounds. All of these projects have been financed by the utilities department and were completely paid for upon completion.

No Debt; No Bond Issue; No Assessment

A total of 116 blocks of streets have recently been paved and paid for from plant earnings, leaving no debt, no bond issue, and no assessment upon the property owners whose property abuts these streets.

The annual budget of the City of Hearne, excluding the utilities department, will average around \$50,000 and the average income from taxation amounts to approximately \$14,000. The cash difference to balance the budget is made up through cash transfers from the utility funds.

According to a recent publication, Hearne enjoys the lowest tax rate in its population bracket in the State of Texas. Since 1944, Hearne has had daily garbage collection service in the business and residential sections, and over one-half of the cost of operating this service is paid from the utilities fund.

Hearne does not have the lowest electric rates in the state, but its rates are nominal and fair and schedules compare favorably with other cities our size. Hearne does make this boast, however: It does have the lowest water rates in Texas, 10¢ per thousand gallons.

In brief, the following figures covering the period 1936 to 1946, will give an idea of the cash benefits the utilities system renders to the city:

Cash transfers	\$161,708.67
Free Services to schools, street lighting, etc.	129,030.84
Operating Profits	394,409.07
Operating Income	682,989.52

After 36 years of operating its own utilities system, Hearne has proven beyond a doubt, that municipal ownership of utilities can be a profitable business. Hearne's plant is now rendering dependable service to its citizenship and the entire population is sold on the idea of municipal ownership. Hearne's annual financial reports reflect a sizeable profit from its utilities that is utilized in building and expansion of the city and its record indicates that its utilities system *PAYS and PAYS and PAYS!*

New Buildings Must Provide Parking

Dearborn, Mich., is the latest city to require that off-street parking be provided by builders of structures for public use. The ordinance which particularly affects new theaters, auditoriums and stadiums, requires provision of vehicle storage space of 200 square feet for each four seats provided in these types of structures.

Parking space requirements are also established for stores, office buildings, banks, restaurants, hotels and numerous other buildings, but churches are excepted.—*Highway Highlights.*

It Is Really a Long Distance and a Lot of Good Pipe

The 200,000,000th mile of vitrified clay pipe was recently completed by the Robinson Clay Products Co. of Akron, Ohio. The Robinson Clay Products Co. is now in its 91st year, and the pipe it produces is of an unusually high quality, as this writer knows from personal experience. The production of this 200-millionth mile was the occasion of a 3-day get-together and planning session for more and better pipe in the future.

Operation and Maintenance of Ironton's Flood Protection

By K. R. WENTZ

City Engineer

DURING January, 1937, the city of Ironton, O., experienced the greatest flood in its history with a record breaking stage of 70' 5", almost 20 feet above flood stage. At least 90 per cent of this small river town of 17,000 population was inundated by the flood waters of the Ohio River. As soon as the flood waters receded, the great and difficult job of cleaning up faced almost every family in town.

In June, 1937, the Congress of the United States passed a Flood Defense Act, and made an allocation of approximately \$25,000,000 for the construction of Flood Defense Works in the lower Ohio River Valley. The City of Ironton quickly presented its problems and claims and on December 8, 1937, flood defense plans which would protect Ironton against a 73-foot flood were approved and funds allocated for the starting of the work.

In order to provide the funds necessary to pay the city's portion of the cost, the citizens voted three bond issues, totalling \$445,000 and, in addition the city issued limited tax bonds in the amount of \$20,000, making a total city investment of \$465,000.

Ground was broken for construction on April 13, 1938, just a few months over a year from the disastrous 1937 flood. Work was completed during the latter part of 1942, and operation and maintenance was accepted in 1943 by the City of Ironton. A Department of Flood Control, Maintenance and Op-



Circular pump station housing four 25,000 gpm pumps.

eration was established by ordinance and a superintendent was selected.

A 0.50 mill levy for Flood Control Maintenance and Operation was placed before the electorate at the regular November election in 1943, and received a favorable vote of 76%. This levy provides the city approximately \$8,000 per year for maintenance and operation, but costs the taxpayer only 50 cents per \$1,000—a very low rate for protection against costly floods.

The Protection Works

The protection works extend a distance of 7.2 miles, consisting of 6.05 miles of earthen levee, ranging in

height from 3 to 50 feet, with a slope of 3 to 1 on the water side and 2½ to 1 on the land side; and 1.15 miles of concrete wall of the standard cantilever type. There are six large pumping stations and four pump manholes to care for internal drainage and sewers. The total pumping capacity is 335,000 gallons per minute. There are 19 gates in the structure, 7 of which serve railroad crossings, and 12 street and highway openings.

The maintenance crew consists of one superintendent and one full time helper. Only during an emergency, when flood gates and pump stations are in operation, does this crew require additional



Left, levee and highway traffic gate; right, concrete wall levee waterside section.

help. During an emergency the entire street department is called into action to erect flood gates. Also, at that time additional help is required to man the pump stations and patrol the levees. This is obtained from several of the local industries, who have offered all the additional help required during an emergency.

What Maintenance Includes

Keeping the grass cut on the 50 some acres of levee is one of the major maintenance operations during the summer. After several experiments we found the Ford Ferguson Tractor equipped with a 5-foot cutter bar solved our problem from the cutting angle. The rear wheels on this particular tractor can be extended to 72", and the low center of gravity makes this machine ideal for this type of work. We have been cutting the levee with this machine for the past three years and have never had the machine overturn. It usually takes about 50 hours to cut the 50 acres of grass and takes about 50 gallon of gas to do the job. We have found from past experience that by cutting the grass when it reaches a height of about 10 to 12 inches and letting it lay and mulch back into the ground proves very satisfactory. We average three cuttings per year, usually in May, June and July.

Each spring the soil is given a treatment of 2 tons of 2-12-6 fertilizer and approximately 30 to 35 tons of ground agricultural lime. It is reseeded where necessary, using approximately 100 lbs. of grass seed per year. The grass mixture we have used the past three years is as follows: 25% orchard-grass, 25% Kentucky bluegrass, 10% Timothy, 20% white dutch clover and 20% alsike, which produces a very well balanced turf.

The pump stations are given a semi-monthly inspection. Each motor is checked once a month by a megger test and all readings recorded on a record card for future reference. Also, once each month each individual pump in each pump station is operated for a few minutes to check for any trouble that might develop. The greatest difficulty that developed in the pump stations occurred during the summer months. During this season of the year the inside temperature and the outside temperature at these pump stations will vary between 30 and 35 degrees. This great variation of temperature caused a condensation to form on the interior walls of all the pump stations, which naturally showed up on our megger tests, giving us some very unusually low readings. To remedy this condition we placed calcium chloride in open containers in each pump station, to act as a drying agent. So far this method has proven very satisfactory and eliminated all traces of dampness.

Since resuming the responsibility of maintenance and operation of the Flood Protection Works the City has expe-



Mowing levee on 2½:1 slope.

rienced only one major flood threat. This flood occurred during March, 1945, when a stage of 60.9 feet was recorded. This was 9.0 feet above flood stage and would have meant an enormous loss throughout the entire business district had it not been for the Flood Protection Works. The damage saved during that one flood more than paid for the original cost of the Flood Wall to the City of Ironton.

The actual cost for labor and electrical energy during that flood was surprisingly low. Total labor was around \$1,300 and the power bill for pumping was \$581—a very low cost considering the damage to property that was prevented.

Methods Used for Testing Highway Bridges in England

Because many old masonry arch and cast iron girder bridges were apparently carrying much heavier loads, without failure, than they were originally intended to support, a study of methods for assessing load-carrying capacity was initiated by the British Government. Many bridges were load-tested, some of them to destruction. Loads were generally applied by jacks lifting against loaded platforms, the load being measured by a proving ring above each jack.

In arches, transverse spread at the crown, longitudinal spread of the arch, rotation of abutments, and strains at various points on the intrados and extrados were observed. On the cast iron girder bridges, deflections of beams and strains in the upper and lower flanges were observed. In 1944, a study on impact was initiated. Values of strain for vehicles moving at uniform speeds were compared with those for the same vehicles under static conditions. Strain gauges of the vibrating wire type were utilized in conjunction with fixed frequency reference instruments. Continuous photographic records were obtained of the strains at given points in the structures.

Further investigations are planned to cover other types of bridges and to supplement the rather incomplete information now available. Impact factors have varied rather widely, and it has not been possible to determine if there is a change in the impact factor with the speed of the vehicle. The most frequently occurring values of the impact factor were in the range 0.96 to 0.98, though

some values in excess of 1 did occur. A noticeable transverse distribution of the load indicates that present methods of design may possibly be revised with a saving in costs of construction. A full account of the investigations is contained in *The Surveyor* for August 1, 1947.

Modern Equipment Excavates Detroit Reservoir Quickly

A 30-million gallon reservoir to serve Detroit's northeast areas is being constructed with the use of modern dirt-moving equipment. The project involves moving 250,000 cu. yds. of dirt from an area 650 ft. square, to a depth of 18 ft. Equipment used includes eight 13-yd. Euclid dump wagons, powered with GM 185-hp. diesels; a tractor-pulled Euclid loader; a Koehring dragline; two LeTourneau scrapers; two Caterpillar tractors; one Allis-Chalmers tractor; a sprinkler truck; a portable Alemite service unit; six Homelite generators and floodlights; a Lima clamshell crane; a Ransome 34E single drum paver; and a Novo pump.

Soft ground, for the first 6 ft. of depth slowed the work, but at the 6-ft. level, a solid blue clay was encountered. Two 8-hour shifts have been employed. In the first phases of the work, with six of the dump wagons in use, an average of 44 loads per hour was maintained. A Caterpillar grader is used to smooth out ruts in the delivery road.

The completed reservoir will be 24½ feet deep, extending 6½ ft. above ground level. About 43,000 cubic yards of concrete will be required for completion. The bottom will be covered with two feet of clay.

Solving Snow Problems in Chicago

To solve the snow removal problem that has long plagued the nation's second largest city, the Chicago City Council recently purchased three Athey Force-Feed loaders, after a survey of 80 midwestern and eastern cities indicated that mechanically loaded truck haulage provided the most practical answer to the problem. After several years of attempting to battle blizzards with hand shovels, Street Commissioner Lloyd M. Johnson asked Mayor Martin H. Kennelly for a committee investigation of the snow-removal problem. The committee made an extensive inquiry into snow removal methods and equipment in use in other cities in the snow belt area, and discovered that Chicago was the only city in the deep snow zone that had failed to equip itself with time and money saving mechanical loaders. The loaders purchased by the Chicago City Council will be concentrated in the Loop area during heavy blizzards, and for lesser storms, two will be dispersed to the north and south side business areas respectively.



Left, depositing chemical; right, street clear of snow and ice.

No More Winter Emergencies in Oneida

By ALBERT T. ERNENWEIN

Commissioner of Public Works, Oneida, New York

KEEPING Oneida's streets clear of ice and snow was once a round-the-clock operation for us. Emergency calls often came at night telling us that certain sections of the city were closed to traffic and had to be opened immediately. That meant so much night work, overtime, and inconvenience for everybody concerned that we decided to overhaul our snow removal procedure. Since then there have been no more emergency calls after hours, yet we have given better service and we have done it at less cost to the taxpayers.

In the past, one of our major problems was keeping the streets and gutters free of ice. At one time our small staff worked nights and week-ends laboriously chopping from 6 to 8 inches of ice out of the gutters. Last year, no matter what the weather was, we kept the streets open, the gutters free of ice, and we did it within normal working hours. As a result, the Department and the public have both been pleased.

It takes good preliminary planning and organization to do this, considering the freezing rains and the 112 inches of snow that we get from November to April. In addition to the heavy falls, we have a number of light snows that grease up the streets and make them extremely dangerous for drivers.

The Police Department helps us when bad weather is brewing by contacting our drivers as soon as the daily weather report is broadcast over the radio. By the time a couple of inches of snow has fallen, our trucks and plows are out on the job.

Our practice is to plow first and put rock salt on the snow that remains to break it up, keep it from freezing into an ice mat on the streets, and help to melt it. Then, if more snow comes, the rock salt also keeps that from freezing until we can remove it and provide bare pavement for traffic. As the snow melts, the weak brine which works under the piles along the curb, combined with rock salt already in the plowed snow, helps to break up the snow banks and keep them

from freezing. In addition, it melts some of this snow, so that by the time the trucks arrive to haul it away there is less of it and it is easier to move.

Streets in and near our business section, dangerous intersections, traffic light stops and all hills are salted first. Then the trucks and plows take care of 20 other intersections at boulevard stops where there are no traffic lights.

On most business thoroughfares our rock salt trucks go down each side of the street, varying the amount spread to take care of the particular conditions of each storm. We have noticed that the salt is picked up by traffic and carried beyond the spot where our application stops, helping to keep the entire street free of snow and ice.

In the city outskirts we leave stockpiles of rock salt for the use of motorists who might get stuck before our trucks arrive. We also salt-treat the parking section in the factory district for the convenience of employees there.

We find that the rock salt used on the snow also helps to keep our catch basins open; they no longer freeze up the way they used to. That saves a good deal of time for us and, combined with the faster, easier plowing job that the rock salt makes possible, enables us to save money on our snow removal job every winter.

Water Supplies and Sewerage Systems in Maryland

At the end of 1946, there were 215 public water supplies in Maryland, 134 of which had treatment plants. At 41 of these plants, the treatment consisted of chlorination only. Also, there were 143 sewerage systems with 118 treatment plants. The final effluent from 60 of these treatment plants was chlorinated before discharge. These data are from the 1946 report of the Bureau of Sanitary Engineering.

Public Works Engineering Methods and Data

Refuse Collection and Disposal in North Dakota

In order to study the garbage and refuse problem in North Dakota, the Water and Sewage Works Conference of that state appointed a committee consisting of A. L. Bavone, E. J. Booth, Everett Lobb, J. H. Svore and John Kleven. This committee has submitted a report which was published in the Official Bulletin of the Conference.

Questionnaires were sent to all communities having a population of more than 300, a total of 178; replies were received from 135, 20 of which reported some form of municipal collection. Of the other communities, 26 had some ordinances regulating garbage and refuse collection and disposal, and 85 had no regulations whatever, 2 reported contract collections.

Of the 20 places reporting municipal collections, 5 collected garbage only; 5 garbage and refuse, and 9 garbage, refuse and ashes. Costs of collection and disposal are financed by 15 of these communities through general funds, that is from taxes, while 5 make a charge to the individual householder.

Of the 20 cities having municipal collection, 11 have year-around collection, and 9 do not. Segregation of garbage is required in all cities having garbage collection. Wrapping of garbage is required in 16 places. The use of modern garbage collection bodies was reported by 5 cities; 7 use closed tank-type wagons; and the rest employ open trucks.

Disposal in 3 cities is by incineration; and 3 others reported the use of landfill, but it was the opinion of the committee that open dumps represented more nearly the system actually employed. Hog feeding was reported by 6 communities. All of the others appear to use open dumps. Of 64 replies received regarding supervision of dumps, 18 cities reported full-time supervision, 17 part-time supervision and 29 no supervision at all.

Of 89 communities replying to a question regarding the location of the dump, only 3 reported the dump

to be more than 2 miles from the city limits. Other replies were: one-half mile or less, 33; one mile to one-half mile, 28. This indicates the relative proximity of rat breeding and harborage places to the center of population. A question of real interest had to do with the local nuisances and problems existing because of these dumps. A rat problem was reported by 38 cities; an odor problem by 23; and dumping of trash along highways leading to the dump grounds by 26.

The conclusions of the committee, in part, were that "the methods employed in the final disposal of garbage and refuse in North Dakota cities is deplorable and a disgrace."

Experimental Studies on Water-Shed Run-Off

Does the cutting of trees impair the quantity or jeopardize the quality of water in the streams draining the area? Does harvesting timber products increase run-off and produce floods? The answers to these and allied problems are being sought in a large-scale experimental project in the Nantahala National Forest, North Carolina. In this project, 28 small, independent drainage areas, ranging from 20 to 200 acres in size, are being studied. Before any changes are made, each water-shed is subjected to a five to ten-year study to determine fully its hydrologic characteristics.

Studies of the effect of clearing and cultivating steep forest lands, of the effect of complete removal of forest trees on stream flow, of woodland grazing, and of logging and burning were undertaken first. To determine how much of the water ordinarily transpired by trees would appear as run-off in the streams if the trees were not there, two areas had all tree and shrub vegetation completely cut back to the ground with as little disturbance of the forest floor as possible. Annual run-off was increased 65% or 17 inches, for the year following, and run-off during the period of low flow was increased more than 100%. There were no significant changes in water quality or in surface storm flow at any time of the year.



The new West Virginia state highway maintenance garage, which has many interesting design features including radiant-type heating and glass block walls, in part, for better lighting.

Stream flow was also increased without any disturbance to water quality in a project in which all trees lower than 15 ft. above the level of the stream bed were cut and allowed to lie where they fell. The increase in base flow of the stream was about 20% during the first year after cutting. The effects of clearing a forested watershed and planting it to corn for four successive seasons, using local farm practices was also investigated. While organic material remained in the soil, there was little change in the infiltration of rainfall; for the first two years there was practically no sediment carried from the area, though the slope averaged 30%. There was a marked decrease in infiltration in the third year. Erosion and surface soil losses occurred; surface storm run-off and peak discharges both increased. This indicates that steep slopes cannot be cultivated for more than a few years without disastrous effects on watershed values.

To study the effects of heavy grazing, a complete watershed area was cleared and grazed for six years during the period May 15 to Sept. 15. Grasses practically disappeared. Porosity in the upper soil layer was reduced, producing an increase in storm run-off. Heavy grazing thus reduced the storage capacity of the soil during storm periods.

Future studies for the outdoor laboratory include the effect of forest fires on water yield and quality; water use by different kinds of vegetation as a guide to best stand management; the effect of watershed management on game fish production as related to stream silting by logging, road construction, and soil cultivation; and the effect of cutting stream bank vegetation on stream temperatures and water quality.

Some of the basic concepts of streamflow are much better understood because of the work done on the various watersheds. For instance, undisturbed forest areas produce a storm run-off pattern that resembles the general pattern from relatively impervious land surfaces during certain types of short intense storms. Accurate measurements of the watersheds proved that this was due to the amount of rainfall that falls directly within the stream channel.

During long, continued storms with low rainfall intensity the amount of storm run-off was far in excess of channel precipitation. Low rainfall intensities precluded the possibility of inadequate infiltration into the forest soil. Coweeta records showed that this run-off was due to a form of subsurface storm flow. Stream run-off patterns were studied with relation to changes in the elevation of ground water table in observations wells. It was proven that the rainfall first entered the soil and then moved laterally through the porous upper layer to the stream channels in time to contribute to the storm run-off.

This is an abstract of an article by Charles R. Hursh of the U. S. Forest Service, which appeared in *American Forests*. The work described here is being done by the Forest Service.

Effect of Rock Salt and Calcium Chloride on Street and Highway Surfaces

A good deal of study has been given to the effect of the application of rock salt and calcium chloride to highway surfaces, and to the possible harmful effects that may result. B. R. Downey, Maintenance Engineer, Michigan State Highway Department, says: "Our Research Division reports that proper or recommended quantities of chloride salts can be used safely on concrete pavements which have reached the age of 5 years or more, or on concrete pavements regard-

less of age which have been constructed with air-entrained cement." The Portland Cement Association says "field observations indicate that concrete 4 years or more in age is unaffected, or is much less affected by sodium chloride than new concrete. Laboratory tests of concrete removed from 6-year old pavements corroborated these observations . . . concrete having excellent durability, as measured by its resistance to freezing and thawing and to the applications of common salt or calcium chloride can be produced with air-entraining portland cements." The Asphalt Institute reports that rock salt "has absolutely no effect whatever on asphalt construction."

Racine Builds Pavement to Fit the Traffic

By W. J. CHADWICK

City Engineer, Racine, Wis.

THE city of Racine is spending approximately \$700,000 for the construction of concrete streets, and an additional \$300,000 is being expended by the Wisconsin highway department to pave state routes through the city, making a total outlay of \$1,000,000 during the year.

Most of the paving we did under the WPA program involved alleys where we used a uniform thickness of six inches of concrete. The alley paving has held up well under the light traffic it is called upon to carry. From this experience we decided that a uniform thickness of six inches would be ample, in our present program, for the short residential streets that are used only by the people who live on them and an occasional delivery truck.

As a further result of our studies, we concluded that a seven-inch uniform thickness would be entirely adequate for normal residential and light commercial areas; and that eight inches would have sufficient load bearing capacity for streets in the industrial areas or on any street that carries buses or is likely to in the future.

On some residential streets which extend through business districts it probably will be necessary to use a nine-inch slab, the same as the state puts down on state routes through the city.

Out of the 79,300 square yards of streets we programmed, 9,900 square yards will be six inches; 21,200 will be seven inches, and 48,200 will be eight inches. Eventually, the bulk of our new concrete streets will be seven-inch uniform thickness because of the greater mileage of normal residential and light commercial streets.

Because salt is used to a considerable extent for snow and ice removal, we specify air-entraining Portland cement for all our new projects. When we first went into the uniform slab we eliminated reinforcing and adopted a policy of using $\frac{3}{4}$ inch dowels only at corners and in expansion joints. Previously we had used eight-inch reinforced concrete, fully doweled, on all streets. Ordinarily, expansion joints are placed 250 to 300 feet apart. If a block is 450 feet or longer, we place expansion joints at each end and in the middle.

Cost is the prime consideration in our street construction policy. We found that there was a difference ranging from 21 cents to 74 cents per square yard

between the cost of six and eight-inch pavement. So by using six inches in some cases and seven inches in another, wherever practical, it means more money for the whole street program. The uniform thickness results in further saving because less special subgrade trimming is required and labor costs are somewhat lower.

Most of our street construction is assessment work, but we try to give the property owners as good a break as possible. For example, if we find it necessary to pave a through residential street with a nine-inch slab, we probably will assess the property owners on the basis of seven inches and the city will pay the difference. The same policy is followed in assessing wide streets. Assessments are levied for a standard width of 36 feet face-to-face of curbs, and the city assumes the cost of any extra width. By this method we will get a surface capable of carrying the heaviest traffic and the cost to the property owners will be that of a minimum standard pavement.—*Wisconsin Municipality*.

Determining the Strength of Clay Subsoils

A new method has been reported by the Northwestern University Technological Institute for determining the strengths of clay subsoils. The method employs a clay specimen one inch by three inches, which is enclosed in a rubber membrane and surrounded by castor oil. A hypodermic needle is inserted in the clay and pressures are recorded on a disk. From the record, the behavior of the particular clay under examination can be predicted, including both settlement and porosity. The work has been under the direction of Prof. P. C. Rutledge, assisted by Prof. J. O. Osterberg and T. W. Van Zelst.

The Unidirectional Runway

(Continued from page 21)

- b. Fewer sites limited by permanent obstructions because only two approach zones are required
- c. Fewer sites limited by grading and drainage problems because of narrow strip of land required.
2. Lower construction cost:
 - a. Smaller land area required
 - b. Smaller paved area required ($\frac{1}{4}$ to $\frac{1}{2}$ conventional airport paved area)
- c. Lower grading costs because of smaller area and greater probability of obtaining site with natural grade approximating finished grade
- d. Lower drainage costs because of great simplification of the problem
- e. Lower maintenance and repair costs because there is less to repair and maintain
- f. Lower construction costs brought about by some degree of standardization of plans and facilities.
3. Easy and economical expansion of airport facilities from the minimum to the maximum required for commercial air transportation.
4. Vastly superior for airline operation:
 - a. Congestion delays eliminated
 - b. Can handle higher volume of traffic
 - c. Taxi time reduced almost to zero
 - d. Substantial saving in fuel due to *a* and *c* above
 - e. Permits simultaneous landing and take-off
 - f. Safer operation due to straight-in approaches, simplified traffic pattern and no danger of overshooting
 - g. During maintenance and repair, field need not be closed.

Thus it can be seen that the community can ill afford to invest in any plan but the unidirectional runway airport, properly developed by rational analysis, if the airport is to be constructionally and operationally economical and adequately fit the needs of the community now and in the future.

Potable Water From Evaporators and Pollution Hazard in Open Sea Shown by Navy Studies.

Studies were carried out in the Long Beach area, California, during April and May 1947 to obtain information concerning (a) the efficiency of various types of shipboard evaporators in furnishing potable water from polluted sources and, (b) the distance at which pollution from a polluted harbor could be detected in the open sea and the pollution hazard of using salt water aboard ships on the high seas.

Four hundred and twenty-eight samples of water taken during the investigations were subjected to laboratory analyses in accordance with A.P.H.A. Standard Methods. Results obtained from the examination of specimens taken from seven different shipboard distilling plants every four hours during 24-hour continuous operation in polluted areas showed that (a) all samples of fresh water were free of coliform bacteria, (b) the majority of salinity cell readings tabulated were below 0.25 gr/gal. and, (c) the temperatures reached in the various types of evaporators studied were effective in destroying coliform bacteria.

During the studies on open sea water, coliform organisms were detected at a maximum distance of two and one-half miles from the San Pedro sea wall and were found also in samples of sea water taken overboard from ships on the high seas proceeding at various speeds, distances, and formations. In no specimen, however, did the coliform density exceed 39/100 ml. and none indicated excessive pollution.

It was concluded that (a) potable, fresh water was produced by all 7 evaporator units studied, even from heavily polluted water, (b) it is desirable to expose polluted water at some point in the distillation system to a temperature adequate to destroy the viability of pathogenic organisms, (c) no significant pollution hazard would obtain in using open sea water aboard ships for normal purposes other than those connected with messing facilities, and (d) in the presence of an epidemic of dysentery or other diarrheal disease and if fecal material from patients or carriers of the causative organisms were being discharged untreated into open sea water, the use of such water aboard ships should be restricted to those purposes in which there would be no contact with personnel. *Bumed News Letter, USN*.

Data on Methods of Use of "1080," a Potent Rat Poison

Sodium monofluoracetate (1080), a highly toxic rodenticide developed during the war, has become a valuable poison in the control of rodents on board ships and at naval establishments in the field. With the removal of wartime restrictions, the advantages of this material are being given publicity. To obviate any mishaps (among naval personnel) and to allay any false impressions of the toxicity of this rodenticide, the following data were published in the U. S. Navy Bumed News Letter, for the information and guidance of navy personnel.

Sodium monofluoracetate is a fluffy, white powder, highly soluble in water. It has a faint acetate odor and a mild acid-salty taste. DO NOT TRY TO CORROBORATE THESE PROPERTIES. It is a stable compound chemically and does not deteriorate when

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mixed with bait or water. It is not corrosive to metals in general. It is relatively insoluble in organic solvents and vegetable fats and oils. Upon exposure to air, the dry, pure powder rapidly takes up moisture from the atmosphere and may become sticky (hygroscopic).

Sodium monofluoracetate is a deadly poison. There is no known antidote. The lethal dose of this poison for man has not been definitely established. However, by comparison with the lethal doses for various animals and birds as shown in the table below, it should be assumed that very small doses could be fatal to man.

Animal or Bird	Amount of poison mg./kg. of body weight	Percent Killed
Albino rat	5-7	50
Norway rat, wild	3-7	50
Roof rat	1-4	50
Cat	0.35-0.5	50
Dog	0.1-0.2	50
Goat	0.7	50
Pig	0.3	50
Horse	1	50
Monkey (Rhesus)	5-7.5	50
Chicken	6-7	50
Mourning Dove	10	33
English Sparrow	2.7	100

First Aid: In case of sodium monofluoracetate poisoning, the patient should be kept quiet. Induce vomiting immediately; then give a dose of salts or other cathartic. CALL A DOCTOR IMMEDIATELY.

Recommended procedure for handling sodium monofluoracetate: (1) Do not breathe the dust or swallow any of the poison. Do not smoke or eat while handling the poison. Keep personal contact with the rodenticide at a minimum. (2) Keep all equipment and supplies plainly labeled. Utensils and equipment must be thoroughly washed after use and not employed for any other purpose. (3) Rubber gloves should be worn while mixing and distributing poison bait. Wash hands thoroughly with soap and water upon completion of these operations. (4) All materials should be kept under lock and key. (5) Clothing worn during the work day should not be worn during meals or in transit to and from work.

Recommended methods for the use of sodium monofluoracetate in the control of rats and mice are: (1) In poisoned water use $\frac{1}{2}$ ounce of the poison per gallon of water. (2) In food baits use 1 ounce of the poison in 25 pounds of bait. These proportions should not be increased. Hazards to other animals are reduced by using the recommended concentrations. The poisoned water may be placed in $\frac{3}{4}$ -oz. paper cups, or other rather small containers, and should be set on absorbent material to prevent contamination of the surrounding area through leakage or overturning. Solid baits are placed according to usual methods.

All domestic animals, poultry and pets must be removed from the area to be poisoned and kept out for at least 5 days. The hazard of secondary poisoning is great. All surface kill of rats and mice should be destroyed by burning or burying 3 ft. deep before releasing animals or poultry that might feed on such dead rodents. All uneaten bait, water and bait containers and contaminated absorbent material should be burned or buried, and thoroughly.

(Ed. Note: This is really big-league stuff, and nothing to take any chances with. Do the job thoroughly and carefully, or else stick to red squill, use traps or follow some other mild method.)



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How to Make Good Sewer Pipe Joints

Specific instructions have been prepared and recently issued by the Clay Sewer Pipe Association, Inc., describing and illustrating the methods to be followed in making good sewer pipe joints. The directions are reproduced with, slightly condensed. If you want an illustrated copy, with drawings showing steps in procedure, write the Editor. Here are the directions:

Cleanliness of the pipe surfaces to be joined is essential. Jointing materials will not adhere properly to dirty, greasy, sandy or wet clay surfaces. Insides of sockets and outsides of spigots or pipe to be joined should be wiped clean and kept clean and dry. If hot-poured bituminous jointing material is to be used, be sure the product is produced by a reputable manufacturer. Follow his direction implicitly, being careful to warm the material so that it will flow easily, but do not heat above the recommended temperature. Clean out the heating kettle frequently and keep the contents of the kettle well stirred.

Mortar Joints should be made of a mixture of one part of good Portland cement, two parts of clean sharp building sand, and only enough water to make the mix workable. All mortar should be freshly mixed and applied in small uniform quantities, each carefully prodded into place and worked to eliminate voids or air pockets. Ram the entire annular space full. Enough mortar should be used at each joint to build up a shoulder outside of the socket, having a slope of about forty-five degrees. Keep water away from the joint for at least 24 hours. Inspect the joint before the trench is backfilled.

Precast bituminous joints should be used as recommended by the manufacturer. As in other joints, surfaces to be joined must be clean and entirely free from sand particles. Because precast joint pipe must be "shoved" home to complete the joint, extra care is needed in trench bottom preparation and placement of bell holes. Be sure all surfaces have a uniform application of the sealing material recommended by the manufacturer and that the material is not allowed to dry or evaporate before the joint is completed.

Sufficient but not extravagant working space is needed. There should be at least 8 inches, but not much more, space between trench walls and the sides of the pipe barrel. Even tight joints can be poor joints if the bottoms of pipe do not form a smooth uninterrupted channel. There should be no protrusions on the inside of the pipe of joint materials, or bumps caused by misalignment of the pipe bottoms.

To keep good joints in that condition, differential settlement of pipe should be prevented. The best preventive is proper bedding of the pipe. Pipe is well bedded when the bottom quarter of the barrel is uniformly supported on undisturbed earth or on a supplementary cradle foundation. Pipe bells should hang free in bell holes. To assure proper bedding, trench excavation should be manually finished to form a trough. Such troughs should be dug out, not built up. In no case should pipe rest on slabs, piers, bricks, etc. If trench bottom is rock, provide a sand cradle, at least 4 inches deep under the pipe to obtain uniform pipe support. Always tamp the backfill material uniformly under the pipe haunches. After joints have been made, build up tamped layers each not over 6 inches thick, until they reach at least 18 inches over the pipe. Tamping under the pipe haunches keeps the pipe from later horizontal displacement.

Always set the pipe accurately before making the joint. Even slight adjusting movements made after the pipe is placed will cause creep of the jointing material along the pipe surface and possible loosening of the jointing material. A well bedded, accurately aligned pipe is easier to join to its neighbor than in one which is out of line.

Preparation for Jointing

Trench made joints all require the following preparation: After the pipe is properly bedded, aligned and butted and after assurance that the entire joint space including the bottom is clean and dry, wind at least three rings of jute or hemp around the spigot end of the

pipe, caulking each ring home into the joint tightly. When complete, the jute or hemp should occupy about one-third of the socket depth. If the joint is to be filled with mortar the jute or hemp should be dipped in Portland cement slurry (a suspension of cement in plain water) just before winding and caulking. If bituminous jointing materials are to be used, the jute or hemp should be dry when inserted into the joint space.

To fill the joint space, first be sure that the space is clean and dry and then fix in place a snake or runner such as plumbers use. The runner should be sealed against the pipe with moist clay. The pouring gate should be near the top of the pipe. Transport the heated jointing material quickly, using as large a ladle or kettle as practicable and keep pouring until the joint is filled. Don't pour too fast or air will be trapped in the joint; don't pour too slowly or the jointing material will cool before filling up the joint space.

Asphalt Pavement Construction Specifications

Construction Specifications. — The Asphalt Institute, 801 Second Ave., New York, N. Y. 304 pp., ills. See below for method of obtaining.

These specifications are designed to provide broad, general standards of acceptable and sound methods and materials for all kinds of asphaltic surfaces. They may need to be adapted to local conditions and adequate provisions are made for this. Contents include: Priming; Surface Treatment; Road-Mix; Penetration Macadam; Base Courses; Cold-Laid Plant-Mix; Hot-Laid Plant-Mix; Miscellaneous; and Asphalt Block Pavement. This text, prepared by the best qualified men in the asphalt field will be sent "on request to Engineers and Officials concerned with such designs, when their request is received on engineering or official letterhead." The Editor of Public Works will be glad to forward your request, or write the Institute.



An IHC TD-18 tractor and Adams pull-type blade grader, owned by the Sullivan County, Ind., highway department, making roadside ditches.

Freeing Curb Boxes of Debris

By H. H. SMITH

Supt. of Water, Painted Post, N. Y.

Compressed air has been employed by the Water Department of the village of Painted Post, N. Y., in a novel way of cleaning out curb boxes over residence service line shutoff valves. It often happens that the cover of the valve rod tube becomes broken or lost and the tube fills with debris of all kinds, including parts of the broken cover, stones, sticks, and caked mud. The depth of the curb box may run from 3 to 7 or 8 feet and, when filled or partially filled with debris, it is impossible to insert a valve wrench or key.

It was found a simple matter to add a piece of $\frac{3}{8}$ " or $\frac{1}{2}$ " pipe to the end of a length of hose connected to the air receiver of a small portable air compressor. By inserting the end of the pipe into the bottom of the curb box tube and quickly opening the receiver valve to give sudden blasts of high pressure air, all debris could be forcibly ejected from the standpipe, even to the extent of removing dirt and gravel from around the valve cock itself.—*New York State Waterworks News.*

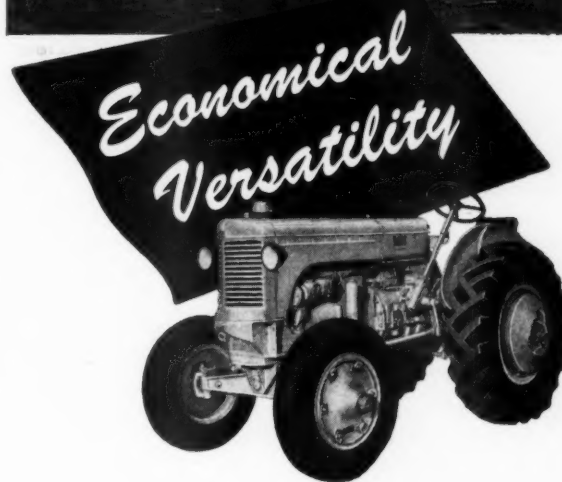
Measuring Soil Moisture Under Field Conditions

A method of continuous measure of soil moisture *in situ* under field conditions by means of a plaster of paris absorption block is discussed in *Soil Science* (Vol. 63, No. 6) by G. J. Bouyoucos and A. H. Mick of the Michigan Agricultural Experiment Station.

For most practical purposes such standard absorption blocks need not be calibrated. Resistance readings may be directly interpreted in terms of available soil water; in all soils the percentage of available water is approximately the same for any given resistance value. The maximum longevity of absorption blocks operating continuously in the field may exceed 5 years in a relatively dry environment. A minimum life of one season is found in waterlogged organic soils.

The advantages of the plaster of paris block method as a soil moisture indicator are summarized as follows: (1) After the initial installation, which is relatively simple, the soil need not be disturbed; (2) readings may be made by unskilled labor; (3) single readings require a minimum of time, generally not in excess of 1 minute; several hundred readings can be made by a single operator in the course of a working day; (4) the blocks may be completely buried so that their presence does not interfere with surface tillage, plant growth or crop production; and (5) the plaster of paris units are not costly, which, with the ease of obtaining individual measurements, makes feasible a large number of replications.

Another advantage of this plaster of paris method is that it gives an indication of the time at which soil freezes, a factor that is sometimes of interest in hydrologic investigations. Freezing within the soil mass is indicated by an abrupt rise in the resistance of the block, caused by a sharp decrease in conductivity of the block as the moisture within it changes from the liquid to the solid state. This transition point cannot be obtained by the use of thermometers, since temperatures considerably below the freezing point may not result in freezing within the soil.—*Highway Research Abstracts.*



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PUBLIC WORKS DIGESTS

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Highways and Airports

This section digests and briefs the important articles appearing in the periodicals that reached this office prior to the 15th of the previous month. Appended are Bibliographies of the principal articles, in which the articles in each periodical are numbered consecutively throughout the year, beginning with our January issue.

The letter and number at the end of each item refer to those used in the Bibliography. Numbers not found in the current Bibliography will be found in the one published the previous month.

The Highway and Airport Digest

Airport Regulations

CAA is now completing proposed regulations to set definite standards for runway length, width, and maximum pavement loading for four classes of service: feeder, local, express, and international. While aircraft design would not be frozen, future planes would have to be planned for standard airports. Pavement loadings, for example, can be reduced by use of multiple-wheel assemblies in landing gears, even though planes grow larger.

For small fields, CAA anticipates major savings through use of the casted gear device which permits crosswind landings. Thus it may be that single strips can be used instead of

cross runways, which require several times as much area and the corresponding expense of construction and maintenance.

At present, some 5,400 airports are in operation in the continental United States; of these 70% are sod fields without paving. Of more than 1,000 airports that have been developed within the past year by municipal and private funds, all but a few are small grass fields for private flying and flight training.^{J11}

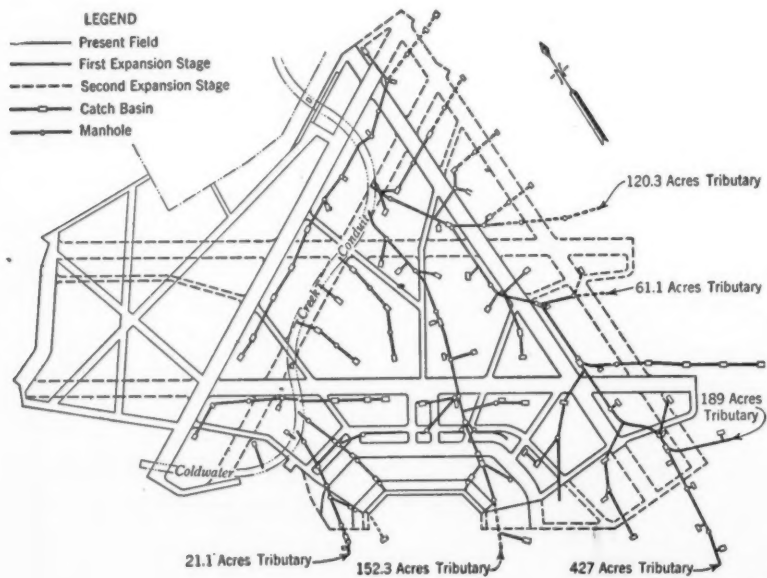
Ponding in Airport Drainage

At properly selected airfields, only isolated and relatively small parts of the area ordinarily will require sub-drainage. Where all-over landing is not

required, established regulations permit the use of low points in the area for ponding rainfalls provided that no rains of 2-year frequency will cause ponding on or within 50 ft. of the runways, taxiways or aprons. In one case this permitted this use of 80% of the total area requiring artificial drainage. Planning for this method requires selection of the 2-yr. rainfall pattern, and of an infiltration capacity curve representative of soil and cover conditions; correlation of these and correction of the net supply pattern by abstraction of retention from the first excess rainfall; determination of the effect of surface detention in altering the shape and peak of the net supply pattern through the requirements of overland or sheet flow; and determination of the effects of pond storage on the shape and peak of the inflow hydrograph in its translation to an outflow hydrograph. The pondage resulting from the very flat grades required in airports can be allowed to "float" on the line; there are very small depth changes for relatively large pondage volume changes.^{K2}

Meteorology and Highways

Meteorological engineering can aid both in the designing of highways and in furnishing to highway users up-to-the-minute information of present and probable weather conditions along routes they contemplate using, thus permitting them to change routes or postpone trips. As an example of the first, along 40 miles of Lake Erie there is a snow belt 10 mi. wide about 5 mi. inland from the lake, where the snowfall is three times as great as on adjacent areas—an area to be avoided in laying out an important highway. Another suggestion connected with snow is the effect of color on melting of snow and ice, which occurs more rapidly on a black surface than on a light one.



Drainage diagram of the Lambert-St. Louis airport.



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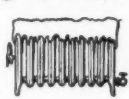
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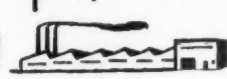

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tors equipped with front-end loaders can produce astounding results when compared with hand shoveling. Sand spreading should be done with self-feeding sanding machines. In normal snow removal, the greatest difficulty is caused by traffic blockades which prevent passage of the equipment. If traffic could be stopped entirely during heavy snow storms, the cost of snow removal would be greatly reduced and the over-all usability of the roads increased. Reporting and forecasting road conditions should be a very important part of any winter maintenance program. Radio stations will gladly co-operate in this, especially if the information is furnished them in short re-

leases which can be incorporated in a news program.^{P32}

Ice Control In Michigan

Michigan uses abrasives on icy roads to prevent skidding, and chloride salts to soften the ice and facilitate removal by blades. The present tendency is to use less abrasives and more straight chemical—the abrasives generally as an emergency measure quickly applied while waiting for the chloride spreader. All spreading should be done by mechanical spreaders, which save material by uniformity of distribution; but there is room for a great deal of improvement in the available mechanical spread-

ing equipment. A comprehensive study has convinced them that recommended quantities of chloride salts can be used safely on concrete 5 yr. old or those constructed with air entrained concrete.

Routine methods have been adopted for sleet or thin ice on paved surfaces, and on gravel surfaces; thick ice or frozen slush on paved surfaces, and on gravel; and hard packed snow. For the first, abrasives are spread; followed, if necessary, with chloride salts, with or without abrasives, at the rate of 500 to 700 lb. per mile, confined to a strip 4 to 6 ft. wide in the center of the road. For thin ice on gravel surfaces, the surface is scored immediately with serrated blades. If this does not bring enough gravel to surface to control skidding, chloride salts are applied and the road scored again if necessary. For thick ice, score the surface with serrated blades to concentrate the chemicals and then apply straight chloride salts at not to exceed 700 lb. per mile. When the ice has loosened, blade the road surface clean if it is a paved surface. If hard packed snow cannot be removed by underbody blades or tractor graders, it is treated the same as thick ice.^{N72}

Winter Work for Highway Grading

The contractor on a highway project in Indiana which included excavating 102,500 cu. yd. of solid rock, principally in five cuts, operated two wagon drills all last winter, using a 9-man crew and shooting the rock but not removing it. When weather permitted grading operations in the spring he had 25,000 cu. yd. of rock ready to be removed. The rock is a very hard shale interspersed with horizontal layers of soft earth 2" to 12" thick. This necessitated careful loading with alternating charges of dynamite and sand packing.^{S9}

A Road Sign Suggestion

An English road user suggests that marks be placed (painted?) on the roadway warning the motorist when to look for a warning sign and thus permit him to keep his eyes on the road at all other times. A series of dots might mean "look out for a sign ahead;" a number of short bars "no left turn ahead;" a number of circles, approach to a traffic circle.^{Y10}

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- 29. Precast Concrete Road Bridge. By W. E. Blackmore. Pp. 469-471.
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- 43. Superhighway to Bypass Pittsburgh. By John R. Dietz. Pp. 82-84.
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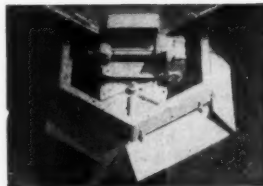


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- K Proceedings, American Society of Civil Engineers**
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- L Civil Engineering**
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13. Broad Aspects of Highway Planning Affect Nation's Economic, Cultural and Social Life. By Charles M. Noble. Pp. 27-31, 78.
14. Meteorological Engineering Aids Highway Transportation. By C. C. Bates and A. H. Glenn. Pp. 40-43, 74.
- N Roads and Streets**
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75. Foundation Designs for a 4-Level Structure at Los Angeles. Pp. 100-103.
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38. Bituminous Concrete Surfaces. By H. D. Metcalf. Pp. 91-92, 122.
39. Frost Damage to Sealed Surfaces. Pp. 110, 112.
- P Public Works**
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32. The Philosophy of Winter Maintenance. By C. L. Motl. Pp. 26-28.
33. How Radiotelephone Helps in Highway Maintenance. By Fred E. Ebel. Pp. 31-32.
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2. Financing Airports Returned to Cities by Federal Government. Pp. 261-265.
- October*
3. New State Laws Relating to Traffic and Aviation. Pp. 287-288.
4. Factors in Leasing Airports to Fixed-Base Operators. By Lynn L. Bollinger. Pp. 290-295.
- Y Contractors Record (England)**
September 5
10. Road Signs. By B. G. Phillips. Pp. 18-20.

Highway Publications

Portable batching plants and equipment for aggregates and cement are described. Ask for Bulletin 2212. Also explained and illustrated are the new twin weighing batchers for one-stop batching of aggregates and cement into two-batch trucks and a new portable bulk cement plant with combination arrangements of bins, permitting easy expansion of capacity where needed. The bulletin has useful references to

storage, handling and weighing of the materials and a listing of available sizes and models.

Road Maintenance.—The 84-HD road maintenance kettle, the 101 utility spray tank, the Trail-O-Roller, and the emulsion patching sprayer are described and helpful information on their application and uses is presented. Littleford Bros., Inc., 452 E. Pearl St., Cincinnati 2, Ohio.

A Rubber-Tired Bulldozer.—The various uses, and the advantages of the Tournadozer, a rubber-tired bulldozer, are illustrated, and the unit is described fully in a folder issued by R. G. Le-Tourneau, Inc., Peoria, Ill.

Earth Boring Equipment.—Equipment for vertical and horizontal drilling, holes 3" to 16", in most cases; air operated. 8 pages. Ka-Mo Tools, Inc., 2121 S. Troy St., Chicago 23, Ill.

Expansion Joints.—A 60-page catalog on expansion joints, with 20 double pages of specific reference data, has been published by Zallea Bros. & Johnson, 841 Locust St., Wilmington 99, Del.

Straight Blade Bulldozers.—A 12-page booklet describes the three sizes of straight blade, cable controlled bulldozers manufactured by Caterpillar Tractor Co., Peoria, Ill.—the 8S, 7S and 6S.

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The Waterworks Digest

Encroachment of Salt Water in Lloyd Sand

The stratum of Lloyd sand in Long Island, N. Y., consists of white sand and gravel generally less than 200 ft. thick, with hard bed rock below and relatively impervious clay above. It dips to the SE at about 80 ft. to the mile, and is at no place above sea level. It has not been traced to its outlet into the ocean, but if the dip continues uniform this outlet is at a depth of more than 8,000 ft. This stratum approximates ideal artesian conditions. Fresh water enters in the upland portion of the island and flows both N and S to the sound and ocean, standing above ocean and sound level sufficiently to counter-balance the heavier sea water, or one foot for each 40 ft. of sea water above the outlet plus the head required to cause the flow through the sand. If pumping should reduce the head below this at any point, salt water will move into the sand. Salting will take place most easily in those areas where the submarine outcrop is farthest below sea level, and will reach most rapidly the wells that are nearest the points where salt water can enter. Encroachment takes place through a narrow wedge-shaped area, wells outside of which are not affected. The salting of Lloyd wells along certain north shore bays is no indication that Lloyd wells in other areas are in danger of becoming salted.^{F69}

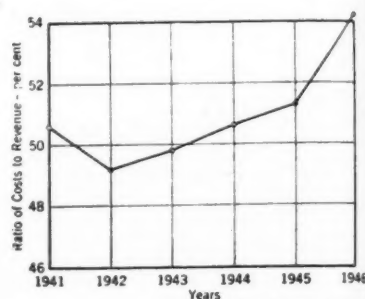
Waterproofing a Concrete Standpipe

Brockton, Mass., in 1911 built two 4,000,000-gal. standpipes of reinforced concrete 160 ft. in diameter and 26½

ft. high. The concrete mix was 1:1:2 in the bottom 10 ft. and 1:1½:3 above this. They were built in 30" courses, each course being a continuous pouring, with a steel dam and a tongue-and-groove in each horizontal joint. For several years no leakage whatever was apparent, but in time some outside spalling began, exposing the reinforcing rods, and in 1945 repairs were decided upon. The inside was wire brushed and washed and covered with a heavy coat of asphalt applied at the melting temperature. On this was placed asphalt-saturated waterproofing felt; and this was repeated until there were 5 coats of membrane and 6 of asphalt. To protect this from ice, which frequently forms in the tank, a 4" lining of brick was placed inside the waterproof membrane. The outside was wire brushed, ¼" galvanized anchors inserted at 4 ft. x 2½ ft. intervals to hold on a 4" cinder block wall, and cement mortar was placed between this wall and the old concrete.^{F29}

Rates and Rising Costs

Data from 100 water works serving 9,000,000 people show that between 1941 and 1946 their revenues increased 19.4% but operating expenses increased 27.8%; the increases between 1945 and 1946 being 4.9% and 11.1% respectively. The prewar net income per customer averaged \$14.65, while the postwar net is only \$9.95. Prewar expenditure for fixed charges was \$7.30 per customer, leaving \$7.35 for new construction. Even if the fixed charges remain the same, the amount available for new construction under present conditions is reduced



Courtesy Journal AWWA

Operating expense-revenue rates.

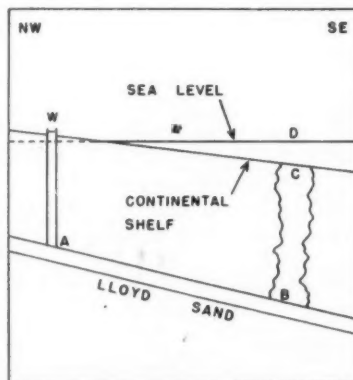
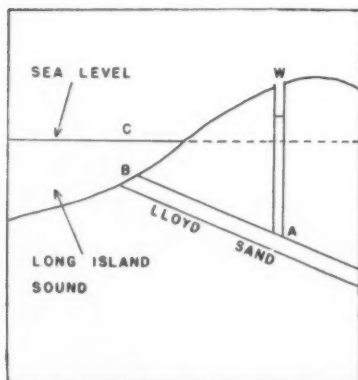
from \$7.35 to \$2.65. But what cost \$7.35 prewar will now cost \$12. Therefore there should be an increase in revenue of \$9.35 per customer, which is 29.2% of the 1945 gross revenue. A comprehensive analysis leads to the conclusions that:

1. Most water works, whether publicly or privately owned, should have increased revenues within the near future, or their service and development must be curtailed.
2. Although each water works should be separately considered, the average increase required throughout the country should be approximately 30 per cent.
3. If the arrangement of the present rate schedule is satisfactory and equitable, the simplest change is the application of a uniform percentage increase to all users. With less satisfactory schedules, the change offers opportunity for study and removal of inequities.
4. There is no completely equitable rate schedule. Each is necessarily tempered with some expediency. A reasonably equitable schedule that is generally acceptable to the customers is better than a theoretically perfect schedule the customers will neither understand nor adopt.^{A114}

Fluorine in Public Water Supplies

During the past three years six cities of which the author knows have begun treating their water supplies with fluorine as an experiment and demonstration of its effect on dental health. Such experiment should, the author believes, conform to the following guiding principles:

Principle 1. Until the periods of controlled experimentation on water have fully elapsed and the findings on those procedures and their effect upon



Courtesy Water Works Engrs.

Salt encroachment in Long Island's Lloyd sand.



Journal AWWA Rates.

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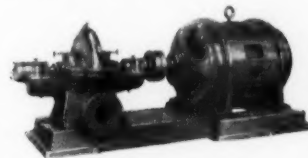
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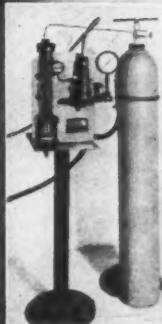
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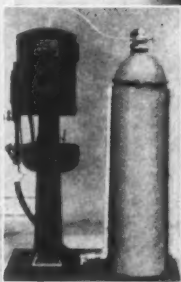
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the exposed population have been authoritatively reviewed and assayed by competent medical, dental and public health professionals, the water works official should avoid the use of the public water supply for medication.

Principle 2. Even at that time, practices for treating the diseases of the people in ways other than through the community water supply should be thoroughly evaluated from the professional and the economic standpoints. In general, such alternative practices, inherently more specific in their nature, are to be preferred.

Principle 3. Universal application of chemicals to water for medication should be predicated upon substantial unanimity of opinion by official medical and public health agencies on the efficacy of the treatment proposed.

Principle 4. A natural prerequisite to any procedure for mass medication through the public water supply is complete concurrence between the officials of the water department and those of the health department.^{A115}

Striking by Public Employees

The author believes that anti-strike legislation is unfair and will not be effective, and urges the American Water Works Ass'n to be "one of the leaders among utility management organizations to promote a forthright policy of management-worker relationship which will make anti-strike legislation inoperative by making it unnecessary." The cardinal points of such a policy are: (1) Public management must be given freedom of action in its relationship with its public utility workers. (2) It must show firmness and fairness in its dealings with the workers. It must not fall back on anti-strike legislation and become either a regimental task master or a hypocritical paternal overseer. (3) Both public management and public workers must realize and carry out their responsibility to the public.^{A116}

Keeping Up-to-date

Methods of waterworks operation have not changed rapidly enough to keep pace with changing conditions. More hand labor should be eliminated. For example, someone should develop a service car so equipped that one or two men can do all the work of cutting, digging, boring, cutting-in valves and back-filling—all with power machinery. More machinery requires a higher grade of labor, and of foremen and supervisors, who must be mechanics and technicians of considerable ability. And the manager must know his waterworks system intimately, from the source of supply to the customers' premises. Foremen and supervisors must be carefully chosen and progressively trained year after year, preferably in state groups. These, in turn, should train those who work under

their direction and should encourage the best of the group to start going through the training school courses so that new leaders will be developing. There should be short courses designed to train men for higher leadership. The higher educational institutions should lay before their students the needs of the waterworks industry for highly trained technical men and top management.^{A118}

Modernizing An Accounting System

The Akron, Ohio, water works in 1940 was serving 56,000 accounts in a city of 245,000 population. At that time it was decided to modernize and mechanize the customer accounting and billing. The reasons were:

(a) A desire to have assurance of the correctness of bills before mailing.

(b) The collection of statistics that were reliable for use in design of treatment and pumping works.

(c) To permit better and more accurate determination of design, maintenance methods and policies for the distribution system.

(d) The desire for a change in accounting procedures so that the financial condition of the department would be continuously available, and the proofing of records a continuous, rather than a periodic process.

It was necessary not only to adopt a new system, but also to devise an interim system for changing from the old to the new. This change has been completed, requiring nearly six years—twice what would have been required but for delays caused by the war.^{F79}

The old blueprinting machine has been replaced with an electric-driven Multilith duplicator having a capacity of 6,000 impressions an hour; a 42" Ozalid ammonia mercury vapor printer of the non-continuous printing and developing type; and a Hunter copyst machine with a 30" x 42" printing surface, together with the necessary developing trays and electric dryer. The Multilith is an offset-type duplicating machine. Ozalid prints can be made with blue, black or brown lines on white and are available for use at once. The copyst is a direct contact, photographic process which makes prints from blue prints, old tracings, or pencil drawings, reproduction of records or abstracts from books. One skilled operator handles all three.^{G38}

Forestry at New Haven, Conn.

The New Haven Water Co. owns 22,000 acres of forest surrounding 17 reservoirs. Of this area, 13% is in conifers, the rest hardwood. Conifer strips are placed between hardwood stands and reservoirs to keep leaves out of the water. They extend right down to the water's edge, with live branches left down to the ground. For Connecticut the ideal forest from the water supply standpoint would consist of hard woods with some hemlock or

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pine, thinned at frequent intervals, with the brush and litter left on the ground to form mulch.^{B27}

Ozone in Water Treatment

Where tastes and odors are severe and the water is flashy and difficult to control, ozone is most effective. Being a stronger oxidant than any other used for water treatment, it will destroy taste- and odor-producing compounds not otherwise affected. For extremely difficult odor problems, ozone can be combined effectively with activated-carbon treatment, to produce a better water more economically than with either treatment alone.

Color can be reduced by long storage periods or by coagulation with alum or lime, followed by filtration. Ozone will remove color with or without filtration. Sometimes, where high colors are encountered, it is economical to follow a coagulation treatment with ozonation, to remove the last 20 or 30 ppm of color, which are often difficult or impossible to remove by coagulation.^{B29}

Distributing Copper Sulphate

The Augusta, Me., Water district has developed a method of distributing copper sulphate in reservoirs which it recommends to others. It distributes a

1% solution from a scow 24 ft. long, 8 ft. wide and 2 ft. deep with an undercut bow, which supports a 4-ton load with 18" draft, driven by an outboard motor. At the stern is a red brass pipe extending horizontally 25 ft. each way from the center of the scow, in which are set 26 tees and 1/2" nipples through which the solution is discharged by means of a 3" trench pump drawing from a tank in which the copper sulphate is mixed by hand. Three men can apply more than 4,000 lb. in 8 hr.^{B30}

Water for Industrial Purposes

Water used for the preparation of ice must be free from color and suspended solids and contain no metallic impurities, such as iron and manganese. The total-solid content should be low and the water should be of the same high degree of purity as drinking water.

For making a good-quality paper, the water must be free from color and suspended solids and from every trace of iron and manganese. The total solids should be low.

In the manufacture of artificial silk, a clear water, absolutely free from color, is required.

For tanning purposes, the water should be free from iron and as soft as possible, because iron and hardness

form insoluble compounds with the tannins.

A most common use is for boiler waters. In this case, the water should be soft, free from suspended solids and low in total solids and carbon dioxide.

Most manufacturers requiring special characteristics either have their own supply or means for treating the public supply.^{B31}

Ground Water For World War II

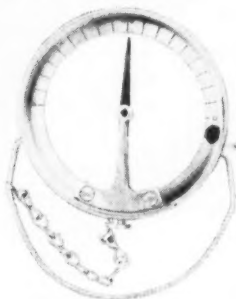
In the urgent necessity at the beginning of World War II for supplying water to numerous military and industrial installations, ground water sources were generally used because they could be brought into production more quickly or because no others were available. The data concerning ground water at most of the locations were scanty, but the U.S. Geological Survey and several State departments furnished what was available. This prevented wasting of large sums of money; but more could have been saved if more data had been collected in the past. The author describes ground water development at four California installations, Schenectady, N. Y., and Fort Dix, N. J. At Schenectady a well was constructed and delivering 3.5 mgd 14 days after beginning work. The sum recommended to Congress for appropriation for ground water activities of the Geologi-

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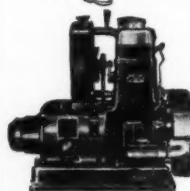
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cal Survey is the pitifully small sum of \$740,000. Said a scientist of the Survey: "In the event of another global war the United States well might be faced inescapably with very wide dispersal of its military and industrial installations. . . . Should our investigations of water resources have continued only in the scope and on the schedule which have been conventional in the past, the nation then would face its water supply problems with a store of knowledge pitifully small indeed." A124

Salt Water Intrusion on Islands

This paper discusses conditions in the Pacific Islands of Oahu, Hawaii, and the Marianas. Only the larger of these, and few of those, have perennial surface streams, and ground water is the sole or chief source of supply. In the permeable soil the fresh water floats on the salt in the form of a double convex lens, extending at any given point 40 times as far below sea level as it does above. This furnishes an enormous reservoir to draw on, but if this draft lowers the top of the lens to sea level, the bottom of it will gradually rise to sea level and eliminate the supply. To prevent this, the skimming tunnel has been adopted as a substitute for wells—a horizontal tunnel so located that it is impossible to draw water from a level less than 2 to 5 ft. above ocean level.

In such islands, the available ground water supply will not exceed $\frac{1}{2}$ or less of the rainfall; the lens must exist in a rock structure with a suitable, moderate and regular permeability; freedom from sea water intrusion depends on suitable rock texture, volume of fresh water flow and freedom from large openings to salt water; stability of the fresh water supply is greater with large flow, in islands of several miles radius, and with regularity of rainfall; water should be so drawn as to avoid undue disturbance of the pre-existing conditions. Skimming tunnels provide the largest capacity and greatest safety from salt intrusion. A125

Legislation to Protect Ground Water

While every state has more or less adequate legislation for protecting surface waters from pollution, little thought has been given to the protection of ground water from industrial wastes that poison the water or render it unfit for human consumption. Pollution that enters ground water travels in narrow bands and so is diluted much less than when discharged into streams. For California there should be a State water authority to plan, administer and enforce the conservation, development, utilization and protection from waste and pollution of all water resources of the state. This authority should contain representatives of water supplies, agriculture, industry, local enforcement agencies, the State Engineer's office and the Departments of Natural Resources, Agriculture and Health. Enforcement

by the lowest local agency that complies with State Standards should be required. A127

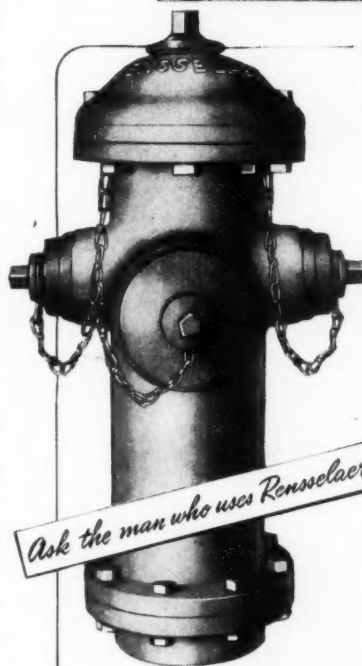
Pollution of Ground Water

Ground water may be polluted by the discharge of sewage and industrial wastes into streams and cesspools; by the addition to it of irrigation water with increased concentration of minerals or carrying nitrogenous fertilizers in solution; disposal of oil well brines underground, and in other ways. These cause bacterial contamination; increased hardness, mineralization, corrosivity,

tastes and odors, and temperature; and may adversely affect crops irrigated by it. For determining whether a ground water is injuriously polluted, the author suggests three different standards for domestic, irrigational and industrial uses respectively; these standards including coliform organisms, sodium ratio, color, turbidity, toxic minerals, heavy metals, phenolic compounds, magnesium, fluorides, total solids, chlorides, sulfates, sodium bicarbonates and boron. He classes water as good for domestic use if it contains less than 1,000 coliform organisms per 100 ml, 20 ppm of color, 10 of turbidity, 0.05 of toxic

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A128

Marketability of Revenue Bonds

Water revenue bonds are somewhat easier to market than power revenue bonds. Sewer revenue bonds have not become so well established and seasoned as water and power bonds, and offerings of these should be accompanied by the presentation of information respecting the properties, operations and finances of the utility in greater detail

than for power revenue bonds. Any publicly owned utilities will find in revenue bond financing many advantages which do not inhere in general obligation financing. It can have greater flexibility and be better adapted to the needs of a utility system. It tends to place the utilities on their own responsibility and to answer the charge sometimes made against some classes of utilities that they are leaning upon tax credit. If a utility is on a revenue bond basis, the management must make good or lose their jobs—a wholesome compulsion which will be welcomed by sincere officials.^{A129}

Revenue bonds have been growing in

popularity but have not been used too extensively, either because of lack of enabling legislation, timidity or lack of understanding. There is a trend towards district commissions or authorities. Some form of revenue bond legislation exists in about 35 of the states, in about 22 of which the authority has been used to a degree ranging from moderate to extensive.^{A130}

Ground Water Law

Legislation on the use and conservation of ground water has developed much more slowly than of surface supplies. Approximately half of the western states have separate ground water statutes; but in the East, only New York, New Jersey and Maryland have made any appreciable progress in ground water control. Kansas enacted in 1945 a statute prepared after a most careful study.

A ground water law should include a preamble stating the need for adopting it; a statement that all ground waters of the state are public waters and available for appropriation for beneficial use, subject to existing rights, and that beneficial use shall be the basis, the measure, and the limit to the use of waters included in the act. The law should be administered by a state authority whose police powers are clearly and specifically set forth, and whose determinations of water rights, both those existing at the date of passage of the act and those acquired after that date, would be subject to review by the courts. It should define vested rights, provide for the reasonable recognition of common-law rights on the part of non-users, and require forfeiture of all rights by non-users after a stated period of time. It should specifically exempt from its provisions water for domestic use, except that furnishing information may be required.

Most ground water legislation is based on three major rules—common law doctrine, American rule of reasonable use, and the doctrine of prior appropriation. Under the last, water is held to be public property subject to appropriation for beneficial use; with a right to use of the water but not ownership of it. Students of the problem judge that this will promote to the greatest extent the orderly and effective development of ground water supplies and will best protect the investments and undertakings which are dependent upon the use of such supplies.^{A126}

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● Effective November 1st, 1947, The Solvay Process Company and Solvay Sales Corporation have been merged into their parent company, Allied Chemical & Dye Corporation. The business of the merged companies will be continued under the name "THE SOLVAY PROCESS DIVISION, Allied Chemical & Dye Corporation" and "SOLVAY SALES DIVISION, Allied Chemical & Dye Corporation," respectively—with no change in personnel. Neither will there be any change in the traditional quality of Solvay products... nor in the dependable Solvay service which has been helping American industry for over sixty-six years.

● In other words, except for changing the lettering on the doors, our sales offices will continue as before at the addresses listed below.

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37. Should Public Water Supplies Be Used for Mass Medication? By Abel Wolman. Pp. 327-331.
38. Labor Saving Through Duplicating With Modern Equipment. By W. R. La Due. Pp. 332-333.
39. The Willow Run Water Softening Plant. By Nicholas Herda. Pp. 334-335.
40. A Copper Sulphate Distributing Craft. By Sidney S. Anthony. Pp. 343-344.
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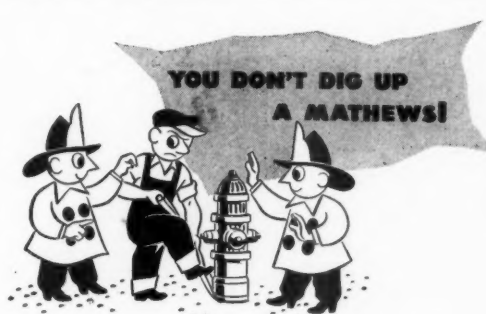
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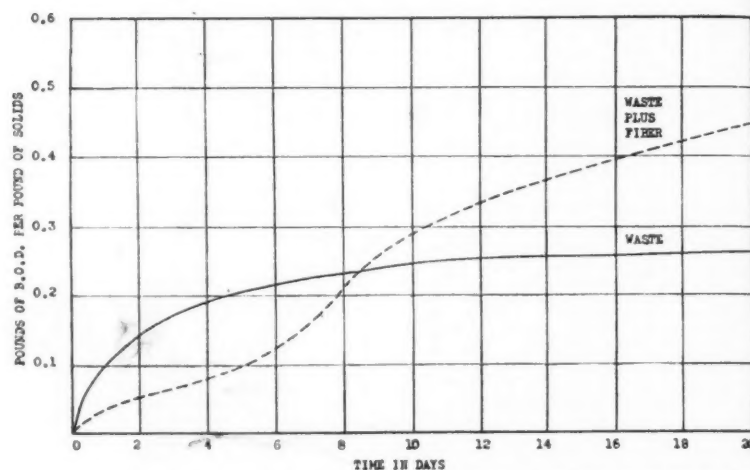
The Sewerage Digest

B.O.D. and Paper Wastes

The B.O.D. test has been severely criticized for frequency of inconsistent results, especially by chemists, by whom a 10% error is viewed askance. It is not without shortcomings, especially when used with some wastes that have high chemical demands. However, if applied to industrial wastes with a knowledge of the requirements of the test and of the character of the waste, together with the selection of a suitable technique, good results can be obtained with most wastes.

Most wastes from the production of pulp, paper and paperboard are more or less deficient in nitrogen and phosphorus, which are so necessary if aerobic decomposition is to proceed at a normal rate, and some contain chemicals that are toxic. Some contain oxygen absorbers. The presence of sulfur dioxide slowly liberated from compounds in which it is loosely bound has a depressing effect on aerobic decomposition. One unsolved problem is the wide variations in the rate of oxidation of cellulose fiber which often seems abnormally slow. Possibly some of the readily available dissolved organic matter becomes absorbed by the fiber in such a manner that it is not easily available to the oxidizing microorganisms. The question of type of seed employed is an important one, on which many operators are working; if an extract from actively decomposing cellulose be used it may alter the picture.

In discussing the paper, Roy F. Weston stated his belief that there is no definite relationship between the chemical oxygen demand and the B.O.D. for all materials or for plant



Effect of added cellulose fiber on oxygen demand of mill board waste.

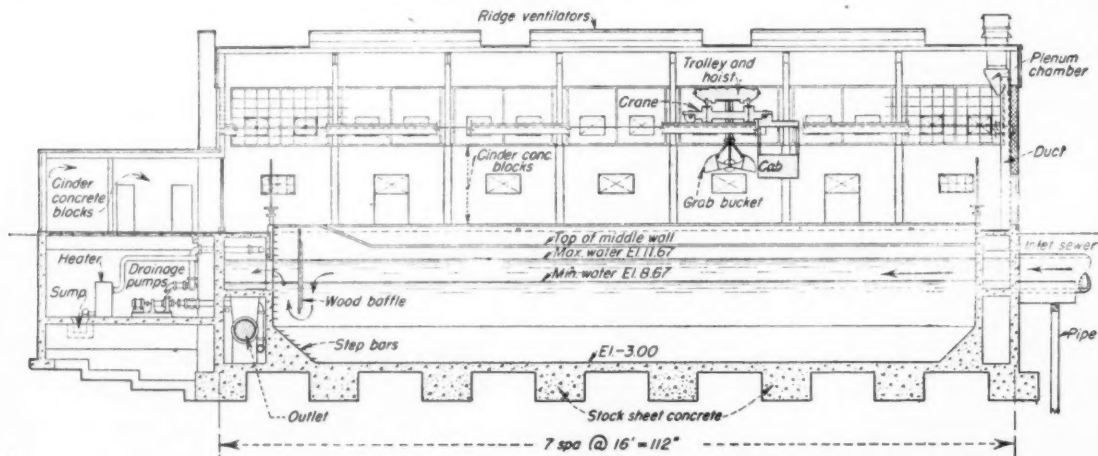
Courtesy Sewage Works Journal

wastes of variable quality, but wastes of reasonably constant composition may show a relatively constant correlation; and that both determinations are essential to a complete understanding of an industrial waste disposal problem. The B.O.D. determination can more closely simulate stream conditions than any other known test method. Improvements in dilution water composition and seeding technics may make it a reliable reproducible analytical method.^{C72}

A Large Grit And Grease Chamber

The sewage of Peabody, Mass., in 1945 averaged 1.5 mgd domestic and 5.9 mgd industrial wastes, with 2.0 mgd ground water. The industrial

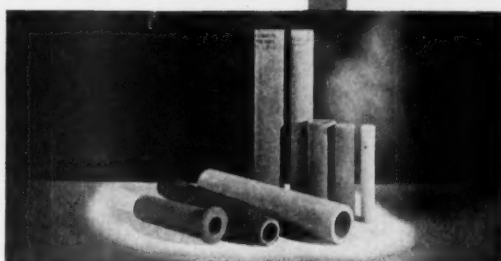
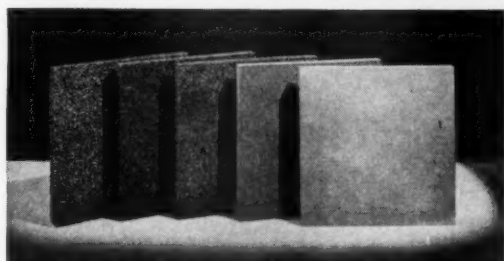
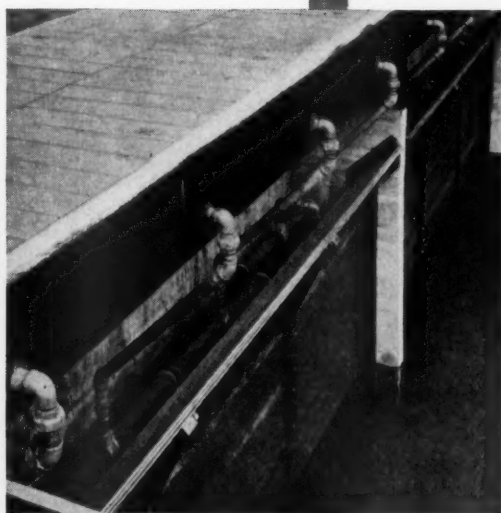
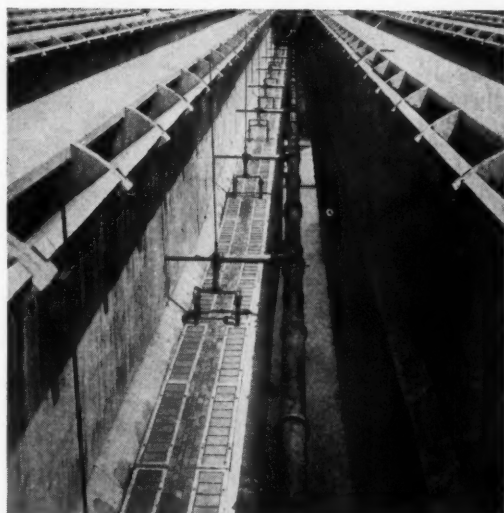
wastes carry large quantities of heavy solids and grease, and even though cleaning of the sewers is continuous it has been found impossible to keep them sufficiently free from bottom deposits and side incrustations to maintain adequate carrying capacity in the 52" to 72" trunk sewer, which discharges into North River. To alleviate this and reduce pollution of the river there was constructed this year a grit and grease chamber enclosed in a building 113 ft. long by 51 ft. wide. It consists of two channels, each 16 ft. wide and 14 ft. 8 in. deep, giving a detention period of 22½ min. or an average velocity of about 4.4 fpm when containing a deposit of 250 cu. yd. of grit, sludge and scum. Grease and scum will be retained by a baffle near the outlet, from which they can be removed by means of



Dual reinforced concrete covered grit and grease chambers.

Courtesy Engineering News-Record

NORTON POROUS PLATES AND TUBES FOR ACTIVATED SLUDGE SEWAGE PLANTS



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a $\frac{1}{2}$ cu. yd. clam-shell bucket operated from an overhead crane. To remove the grit and sludge, one channel at a time will be taken out of service, the liquid pumped out into the inlet of the other channel (which will require $2\frac{1}{2}$ hr.), and the solids removed by the clam shell.^{E18}

Tunneling a Large Sewer

In Fifth St., Washington, D. C., 2700 ft. of circular sewer 7 ft. and 7.5 ft. inside diameter is being constructed with invert 25 to 40 ft. below the surface. About 600 ft. is through soft decomposed rock, 500 ft. through hard granite, 900 ft. through a mixture of decomposed rock and clay, and 700 ft. through clayey sand and gravel. Tunneling is conducted from two shafts. Excavation is by the top-heading-and-bench method. Excavated material is loaded by hand into 1-yd. boxes which are taken to the shaft on cars running on a 16" gauge track and lifted to the surface by a crawler crane; an empty box meantime being placed on the car and run to the heading. The excavating crew consists of 4 miners using pneumatic tools, 8 muckers and two men shifting the cars. Dynamite is used in $2\frac{1}{2}$ " holes 6 ft. deep for a 5 ft. advance per blast. The arch is lined immediately behind the excavation with 16" x 36" steel liner plates bolted to-

gether, and the concrete is placed as soon as 30 ft. of tunnel is ready, delivered in 4-yd. truck-mounted mixers and pumped to place through 6" pipes. The invert is lined with vitrified brick to resist abrasion.^{E19}

Garbage Disposal With Sewage In the District of Columbia

During 1946 the total production of garbage in the District of Columbia was approximately 100,000 tons, of which 13% was processed at a reduction plant and the remainder fed to hogs. Probably more than 1,000 household garbage grinders are in use in the district, discharging ground garbage into the sewer, and the number is expected to increase as they become available. Estimates have been made of the increased cost of treating the sewage if 100 tons of ground garbage per day is added to it in 1975, when it is estimated that the population will have increased from the present 1,000,000 to 1,500,000. The BOD of the sewage alone will, it is estimated, be 300,000 lb. daily, and that of the garbage 14,000 lb. The sewage now is treated by sedimentation preceded by grit chambers and preaeration; the sludge and scum being digested, elutriated and vacuum filtered. It is estimated that the additional cost per ton of garbage treated, due to similarly treating the garbage with the sewage, would average 87 cts., or 8 cts. per

capita per yr., and that 4 gal. of water per day per household would be used in operating the household grinders. It is estimated that the additional gas produced in the digestion tanks would be worth \$27,500 per yr. The increase in capacity of plant required would cost \$320,000.^{H43}

Hourly Variations in Sewage

During 10 weeks the operator of the treatment plant at Aurora, Ill., where the sewage is generally domestic, made 24-hr. studies of typical dry-weather flow for each day of the week, samples being collected at 2-hr. intervals and analyzed for suspended solids and 5-day B.O.D. It was found that curves for 5 days were almost identical with those for 10 days. Suspended solids averaged 174 ppm and B.O.D. 168 ppm. (Yearly averages including more diluted sewage during storms were 166 ppm suspended solids and 122 ppm B.O.D.) The rate of flow on Sundays varied 13% above and below the average, and the sewage load 80% above and below. On Monday the flow averaged 28% above and below the average and the sewage load 84% above and 164% below. During the other five days the flow averaged 25% above and 20% below and the sewage load 60% above and 80% below.

Time and incubator space necessitated making 2-day B.O.D. tests in-

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stead of 5-day; but on 30 days both were used to provide a comparison. Ten Sundays averaged 120 ppm by 2-day tests and 131 ppm by 5-day; 10 Tuesdays averaged 195 and 183 respectively, and 10 Thursdays 153 and 141—an average difference of 2.6%.^{C84}

Objections to Five-Day B.O.D. Test

In a discussion of a paper describing operating experiences at the West Middlesex, England, treatment plant (see Digest D 27), W. I. Lockett, chief chemist of that plant, said he thought a complete revision of the B.O.D. test was in order. From time to time a number of extraordinary results were obtained on applying the five-day test. Mr. Edmondson had pointed out some years ago that certain effluents he had obtained were satisfactory in every respect except as regards the five-day B.O.D., and the relatively high figures obtained by this test had been shown to be due to oxidation of ammonia and nitrite occurring during the five-day incubation period required for carrying out the test. The same phenomenon occurred occasionally with effluents obtained from the Mogden activated sludge plant, and he understood that it also occurred sometimes with effluents from land filters. At Mogden when relatively high B.O.D. figures occurred it was nearly always during the Spring, i.e., when, as a result of rising temperatures, nitrification of the sewage by the activated sludge was improving and becoming more intense; thus, although the B.O.D. figure indicated that the efficiency of the plant was falling off, in reality the efficiency was improving and the nitrifying organisms were becoming more active and stronger every day.

Again, anomalous B.O.D. results were sometimes obtained owing to differences in the composition of the dilution water. The mains water supplied to the Mogden works often contained chlorine, and on that account was unsuitable for use. Water, free from chlorine, was obtained elsewhere for carrying out the test. It might be, in the course of time, that the general adoption of a standard diluting water would become a necessity.^{D32}

Florida Pilot Treatment Plant

The University of Florida now is operating a full-scale testing or pilot plant treating sewage from the campus buildings. The present design capacity is 60,000 gpd in two units, and another 30,000 gpd unit is planned. The layout covers about an acre and includes a control laboratory building with 1800 sq. ft. of floor space. Apparatus includes a mechanically cleaned bar screen, a screenings grinder, 3 primary treatment units; a 30,000 gpd rectangular primary sedimentation tank; Imhoff tank; intermittent sand filters;

trickling filters; digesters; chlorine contact tank; and sludge drying beds.^{E17}

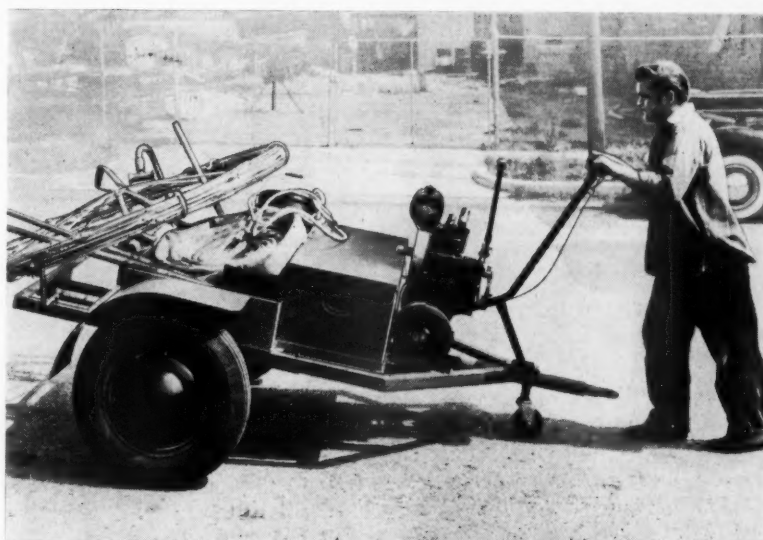
Carbide Lime Slurry For Sludge Conditioning

Two cities, Wyandotte and Detroit, Mich., have recently substituted the use of carbide lime slurry from acetylene gas plants for pebble lime for conditioning sludge for vacuum filtration, because of the increased price and scarcity of lime. Wyandotte purchased the slurry for \$1.00 a ton at the gas plant. It varied in solids content from 2.25 to 3.75 lb. per gal., the calcium as CaO varying from 71 to 75%. Each load was analyzed and sufficient water added

to maintain a concentration of 2 lb. of solids as calcium hydroxide per gallon. The annual savings in cost of chemicals was slightly under \$5,000. Changes in the plant to permit its use cost \$2,765. Other advantages are less attention by operators necessary and absence of lime dust.

At Detroit, the use of this slurry has proved it to be as suitable for sludge conditioning as pebble lime; it requires less power equipment in continuous operation, is capable of easy handling, and is effecting a decided economy. It eliminates the need of hot water for slaking, the accumulation of deposits of foreign matter in the slakers, and erratic sup-

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ply. The ferric chloride dosage was unaffected by the change. The cost of chemicals per ton of dry sewage solids is 25 to 40 cts. lower.^{C66}

Spray-Drying Filter Cake

Apparatus for filtering sludge on a Titeflex-Wright cord vacuum filter and spray-drying it has been developed at Plainfield, N. J., and details of the information obtained are described. It is stated that, using the plant now offered for use, the operation costs of the spray drier per 1,000 lb. of dry solids per hr. are: for labor \$1.00 (one hour); power 75 cts. (30 kw); fuel \$4.70 and maintenance 10 cts.; or \$6.55 if operated for drying. If the dried sludge is used for fuel, the cost is reduced to \$2.12. Current is charged at 2.5 cts. per kwh.^{C67}

Maintaining Dayton's Sewers

The personnel of the Division of Sewer Maintenance of Dayton, O., includes the superintendent, 2 clerks, a supervisor, 5 foremen, a building tradesman, a stock keeper, a handy man, 2 emergency men, a compressor operator, 3 truck drivers, 3 repair men, a night watchman, and 20 to 25 sewer cleaners and laborers. The emergency crew consists of a foreman and 2 helpers and operates a truck equipped with Flexible sewer rod, fire hose, shovels, picks, lights, telegraph spoons, etc. In general, it is the trouble shooter for every-day complaints. The catchbasin crew consists of a foreman, 2 loaders, 10 sewer cleaners and 2 dump trucks. The sewer cleaning crew varies from 8 to 16 men. It operates 2 power-driven sewer-cleaning machines mounted on trailer trucks, which include steel drums carrying 750 ft. of cable, various sizes of expansion buckets; also a Flexible sewer rod unit, 2 portable electric light generating plants for night work, and 2 Home-lite pumps. By using power cleaning machines they have cleaned 30" pipe at a cost of 11¢ a foot which would have cost 60¢ by hand power.^{J15}

Winnipeg's New Incinerator

This incinerator, which is expected to be in operation by November, 1947, contains three "Monohearth" furnaces, each with a capacity of 100 tons in 24 hr. There is a tipping floor 73 x 45 ft.; a storage bin 73 x 24 x 18 ft. deep; an electrically operated 4-motor bridge crane of 4-ton capacity; 3 1-yd. pneumatically operated charging containers; for each furnace, 2 forced-draft fans with a total capacity of 4 lb. of preheated air per pound of refuse; 4 stoking doors for each furnace; and ash hoppers with water sprays. The chimney is 175 ft. high, of reinforced concrete with an independent firebrick lining.^{J16}

Direct Oxygen Method In Waste Treatment Studies

The dilution method of determining B.O.D. is very useful in estimating the strength of sewage and the efficiency of treatment. But there are indications that with certain industrial wastes the de-oxygenation rate is not independent of the dilution or concentration. The use of mineralized dilution water fortified with nitrogen and phosphorous, the correction of the pH value, and proper seeding do not always give consistent values with such wastes, the B.O.D. varying with the dilution. The B.O.D. exerted in a treatment plant or in a stream may be entirely different unless the degree of dilution happens to correspond to the dilution used in the B.O.D. determination. It often happens that the oxygen demand is relatively higher in the diluted sample than in the original waste, probably because there is an inhibiting agent in the waste which at some point of concentration is sufficiently diluted to permit the oxygen demand to be fully exerted.^{C73}

Legislation to Control Stream Pollution

Stream pollution control is now vested in the State dept. of health only in 10 states; in an agency separate from this department but closely allied to it, with technical service furnished by it and a representative of it serving as a member of such agency, in 11 states; in the State dept. of health and other agencies in 17 states; in a water pollution control board separate from the health dept. handling all water pollution control activities in 4 states; and 6 states have no state agency.

The fact that the pollution problem extends beyond the state borders does not make Federal control necessary; legal action in the Federal courts may be undertaken where real danger occurs. But it is more desirable that states join together through interstate compact agreements on a unified water pollution control program. Certainly this is preferable to granting broad mandatory powers to the Federal government. The principal service the Federal government could render would be to promote, coordinate, and even carry out research in the field of sewage and industrial waste treatment. If the states neglect their pollution control duties, Federal legislation may become necessary, but should be restricted to interstate streams, should foster the formation of interstate compacts, and should limit the issuance of Federal orders for abatement of pollution of interstate streams to extreme cases where states will not assume their responsibilities.^{C74}

Moisture Control In Masonry Structures

Where concrete in above-ground structures spalls and is to be repaired, the concrete used should be made waterproof with admixtures. Protection of

existing surfaces can be effected with either surface materials or penetrating materials. To prevent the new concrete from shrinking from the old, metallic-type admixtures are the most satisfactory available, these expanding sufficiently to compensate for the shrinkage of the concrete during curing. If the surface of this is to be painted, a rubber base or resin product paint should be used; or a fatty acid admixture should be used, which permits the use of ordinary oil paints. Waterproofing by surface materials has some merit, but few of them will give their advertised efficiency. Moistureproofing rather than waterproofing is the real remedy, and a combination of a penetrating material and plastic coating, of the oil rather than asphalt type, is advised.^{C77}

Overloaded Filter Plants

Walla Walla, Wash., treats its sewage on a standard trickling filter with a designed capacity of 6 mgd, built in 1928, and a 2-stage bio-filtration plant of 0.6 mgd capacity which includes a "Vacuator," built by the Federal government. Since 1933 three pea-processing plants have gone into operation and their wastes at the height of the season raise the BOD of the total sewage from a normal of 300 ppm to 600 or more, and increase the quantity from about 3.4 mgd to 7.5 or even 8.2 mgd; thus more than quadrupling the organic load. During the pea-processing season the overall reduction in BOD is practically nil. The standard (low-rate) filter treats momentary overloads without serious deterioration of the effluent, and after long-continued ones recovers immediately when the organic overload is reduced. The bio-filtration plant is operated at a constant rate, but the BOD in ppm is doubled, in spite of which the results continue good, the "Vacuator" materially increasing the suspended solids removal.^{J12}

Effect of Nickel on Sludge Digestion

A study of the toxic effect of various concentrations of nickel on sludge digestion strongly indicated that concentrations of nickel sulfate and nickel ammonium sulfate up to and including 500 ppm as nickel does not retard normal sludge digestion, but rather tend to increase the activity, resulting in slightly greater gas production. In concentrations of nickel in excess of 500 ppm, and especially in excess of 1,000 ppm, the digestion processes are definitely retarded.^{C65}

Sand Filtration Of Organic Wastes

Laboratory experiments in treating a number of organic wastes on sand filters were conducted by settling the wastes and distributing them on the filters in a manner similar to trickling

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filters. The strength after settling varied from 1,350 to 20,000 ppm of BOD. The sugar and sulfite liquor wastes contained insufficient nitrogen for rapid biological action and were fortified with ammonia, about 1 ppm ammonia to 15 ppm BOD. Loadings varied from 167 to 1735 lb. of BOD per acre per day. Up to 1,000 lb. of slaughterhouse, penicillin and candied fruit wastes were reduced to less than 5 ppm BOD; of yeast waste to less than 10 ppm; and of sulfite to less than 40 ppm. Nitrification was high. Back washing removed surface clog-
ging.^{G28}

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66. Carbide Lime Slurry for Sludge Conditioning. By Harold M. Leonhard. Pp. 796-805.
67. Experiences in Thickening and Drying of Sludge. By Thomas R. Komline. Pp. 806-810.
68. Regulation of Industrial Usage of Municipal Sewers. By Clyde L. Palmer. Pp. 811-816.
69. An Industry Initiates a Waste Control Program. By J. E. Cooper. Pp. 817-826.
70. Recent Developments in Pulp and Paper Waste Treatment and Research. By Harry W. Gehm. Pp. 827-829.
71. Characteristics and Methods for Treatment of De-inking Wastes. By Willard W. Hodge and Philip F. Morgan. Pp. 830-864.
72. Problems in the Application of the Biochemical Oxygen Demand Test to Pulp and Paper Wastes. By Harry W. Gehm. Pp. 865-874.
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74. Federal and State Legislation for Stream Pollution Control. By Warren J. Scott. Pp. 883-889.
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17. School Tests Sewerage for Florida Towns. By D. L. Emerson, Jr. Pp. 8-9.

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18. Grit and Grease Chamber Reduces Sewer Cleaning and Pollution Problems. By Frank L. Flood. Pp. 91-93.
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28. Sand Filtration of Some Organic Wastes. By Willem Rudolfs and Victor Del Guercio. Pp. 349-351.

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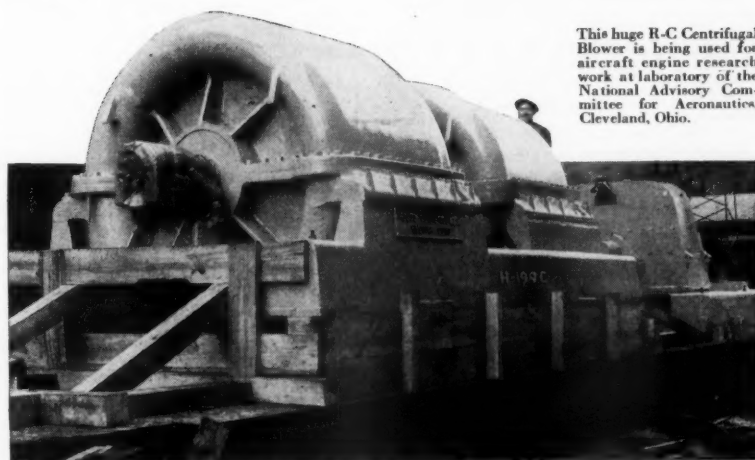
43. Garbage Grinding Planned for the District of Columbia. By Ralph E. Fuhrman. Pp. 518-520, 525.

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44. Sewage Disposal in China a Major Problem for the Future. By John R. Snell. Pp. 526-527.
45. Fort Wayne Sewage Gas Engine Nets \$199,000 in Six Years. P. 527.
46. Cross-Connection Hazards at Sewage Plants. Pp. 534-535.

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Y Contractors Record (England)

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5. The Capacity of Percolating Filters. By L. B. Escriott. Pp. 13-16.

Pipe and Leak Locators for China

Allen-Howe Electronics Corporation of Peabody, Massachusetts, recently made a large shipment of their A/H pipe locators and A/H leak locators for rehabilitation work in China. These instruments for the location and tracing of underground pipes and location of underground leaks are considered essential by our government and the shipment of this Allen-Howe equipment from Peabody, Massachusetts, half way around the world to China serves to indicate the many commercial items aside from food that the United States must supply to the war torn countries of the world. Similar equipment was recently purchased for use in Brazil, Poland and Russia.

Corning, N. Y., Contracts for Incinerator

The city of Corning, N. Y., has awarded a contract for construction of an 80-ton incinerator to Nichols Engineering & Research Corp., at a cost of \$176,920, which includes a monorail type crane and bin.

Toll Roads Authorized by Seven States.

With the close of most state legislatures, this is the current toll road picture in the United States:

Colorado has legislation enabling

construction and financing of a four-lane toll highway between Denver and Boulder.

Georgia has authorized construction of a scenic coastal toll road.

Illinois left on its books a 1943 law creating a super-highway commission with broad toll-road powers.

Maryland revised and enlarged the existing authority for construction of toll roads.

New Hampshire has been authorized to build an 18-mile toll highway from Seabrook to Portsmouth.

Oklahoma has created a turnpike authority to build a Tulsa-Oklahoma City expressway.

West Virginia gives wide authority in construction of toll roads to a new toll road commission, but no specific routes have been announced.

Other related actions:

California broadened the authority of its toll bridge commission to include approach roads, but rejected a plan for a huge network of toll roads.

Pennsylvania legalized the combining of revenues from its present turnpike with those from proposed eastern and western extensions in order to finance the extensions. Work on the eastern extension is expected soon.

Maine has a toll road under construction.

Besides Pennsylvania, states with existing toll roads are New York, Connecticut and Florida. Certain other states have special-purpose toll roads already built.—*Highway Highlights.*

Vibroflotation for Compacting Sand Or Loose Soil

A new method of packing large areas of loose soil or sand to support airport runways, foundations, etc., has been developed. This employs jets of water and vibration for consolidation. Weighing 2500 pounds, the special unit can be attached to standard types of construction cranes. It can pack an area of 100 sq. ft. to any required depth, to 100 ft., at each application. For further information write Merritt, Chapman & Scott, General Contractors, N. Y.

Institution Kitchens

A Scientific Basis for the Design of Institution Kitchens—By Orpha Mae Huffman Thomas. Columbia University, New York 27, New York. 1947. Paper. Pp. 80. Price \$3.00

The purpose of this book is to devise a scientific method for finding the number and sizes of various pieces of equipment required in institution kitchens and for the placement of such equipment in order to obtain the most effective use of labor. The book contains tables of capacities of equipment in terms of foods which it is possible to process in these pieces, and data on the time that the machines are required for various operations.

Sewerage and Water Works Publications

Treating Municipal and Industrial Waters.—This is a 90-page handbook. It describes briefly the various treatment processes, particularly those involving the use of alkalis or chlorine. There are nine chapters: Natural water and its impurities; water softening and its advantages; the lime-soda process; the zeolite process; municipal water purification; industrial water purification; chemical feeding equipment; and useful information. It is not a general reference work, but a valuable technical publication. We believe it will be sent on request to Solvay Sales Corp., 40 Rector St., New York.

Ion Exchange.—A bulletin explains methods and processes used for many industrial problems. Liquid Conditioning Corp., Linden, N. J.

Corrosion Resistance Guide.—Lists 155 corrosives in alphabetical order and shows the duriron alloy most resistant to each. Ask for Bulletin 100, Duriron Co., Dayton 1, O.

Lining Water Mains.—This is an instructive booklet that every engineer and superintendent in the waterworks field ought to read. With numerous photographs and charts it shows the

methods of applying cement mortar linings to water mains and presents data on the effectiveness of such linings. Centriline Corp., 140 Cedar St., New York 6, N. Y.

Pneumatic Control Valves.—This is a complete 36-page bulletin. Contains much information, including specifications, on control, needle type, poppet and butterfly valves, with data, tables and formulas for determining proper valve sizes. Foxboro Co., Foxboro, Mass.

Corrosion Resistant Materials.—A new 16-page bulletin on this subject has been issued by U. S. Stoneware Co., Akron, O. Sent on request to R. W. Grace; ask for Bulletin K.

Corrosion Resistant.—A 12-page manual on the corrosion resistance, proper installation and use of Duriron acid proof sinks, sink strainers, traps and pipe and fittings. Duriron Co., Inc., Dayton 1, O.

Centrifugal Process Pumps.—Allis-Chalmers Mfg. Co., Milwaukee 1, Wisc., has issued a 4-page folder on pumps for handling corrosive and abrasive liquids.

Caterpillar and Sanitation.—The part played by diesel power in garbage and sewage disposal, water supply and purification and pest extermination is outlined in an 8-page booklet. Caterpillar Tractor Co., Peoria 8, Ill.

How to Figure Voltage Drop.—De-

tailed information on figuring voltage drops, with examples to show the use of curves, is one feature of a 16-page booklet issued by Electric Machinery Mfg. Co., Minneapolis 14, Minn. Ask for Vol. 8, No. 2.

Zeolite Softeners.—New 20-page manual on need for water softening, methods and applications to canning, laundry, textile and other industries. Three pages of chemistry. Ask for No. 4345. Cochrane Corp., Philadelphia 32, Pa.

Special Machinery.—Illustrations of lock and dam equipment, gate and valve lifts, bridge operating machinery, etc., which can be built to any specification. Foote Bros. Gear & Machine Corp., Chicago 9, Ill.

Leakproofing.—A 12-page booklet tells how to waterproof leaky basements, pits, dams, etc. Ranetite Mfg. Co., St. Louis 4, Mo.

Valve Controls.—A 4-page folder by Shafer Valve Co., Inc., Mansfield, O., describing valve controls for handling water, gas, oil or steam; 1-inch and up; pressures from 25 to 6,000 pounds.

Best Joints for Clay Pipe.—Here are detailed data, with clear illustrations, showing the best ways to get good joints for vitrified clay pipes. Covers both bituminous and mortar joints, and precisely how to make them. Clay Sewer Pipe Association, Inc., Huntington Bank Bldg., Cleveland, Ohio.

MASS ACTION OF ACTIVE AEROBES

provided by ACCELO* FILTER SYSTEM

The greater the number of active aerobes in a trickling filter, the faster and more complete is the reduction of the organic matter in sewage.

That is the fundamental theory behind the Accelo Filter System of Direct Recirculation. The trickling filter effluent is teeming with active aerobes, and by returning the unsettled filter effluent directly back to the filter the number of active aerobes in the filter is increased to myriads.

It is the UNSETTLED trickling filter effluent returned DIRECTLY to the filter that provides Mass Action of active aerobes. The aerobic bacteria in the unsettled effluent have been well supplied with oxygen and are in their most active state. Their span of life is from 3 to 5 minutes, and within that time they divide and multiply. To take advantage of this tremendous activity, the Accelo Filter system returns the unsettled effluent directly to the filter.

Write for authentic operation reports of Accelo Filter plants for proof of improved treatment results.

INFILCO Inc., 325 West 25th Place,
Chicago 16, Ill.

*Trade-mark Reg. U. S. Pat. Off.

Get The Facts About **FLEX-O** Makes 90° Bends



FLEX-O is hydraulically operated. Cleans entire pipe surface 4 times. You can clean up to 1 mile a day in 6" mains—more in larger sizes. No rods, cables or pulling devices

needed with FLEX-O. Heavy duty construction. Fully guaranteed. Send for full details. THE CARVER-STIMPSON PIPE CLEANING CO., Walters, Okla.

MAIL COUPON TODAY

The Carver-Stimpson Pipe Cleaning Co., Walters, Okla.

Without obligation, send full details and prices of FLEX-O Hydraulic Pipeline Scrapers.

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State _____

When writing, we will appreciate your mentioning PUBLIC WORKS

PUBLIC WORKS Equipment News

A Truck That Should Be Useful in Public Works

The Milford special service truck is a combination of a truck and a 4-wheel, dual tire, rear extension; it is not a trailer, nor a typical heavy duty truck. It is equipped with a crane. For hauling, loading, unloading and placing pipe or other heavy materials, this truck should be most valuable and a money-saver. It is available in two sizes—33,000 and 48,000 lbs. The description sent us is too technical for condensation. We suggest you write Milford Crane and Machine Co., Milford, Conn.

A New Leak Detector for Accurate Location of Leaks

Operating on the principle of the seismograph, this new leak locator enables the accurate location of underground leaks—water, steam or gas, and within a radius of inches. This new locator consists of two detecting units

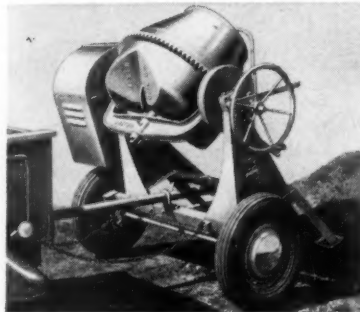


Allen-Howe leak detector.

coupled to special earpieces and by accurately spotting the exact location of the leak, reduces excavation and subsequent street repair work. This new locator is described, along with pipe locators, dipping needles and pipe phones in a new catalog which will be sent on request. *Allen-Howe Electronics Corp., Peabody, Mass.*

New Small Concrete Mixer for Speedy Work

There are many new ideas in this 3½-S mixer for concrete, plaster and bituminous materials. It may be backed directly up to material piles and is



New Jaeger 3½-S mixer.

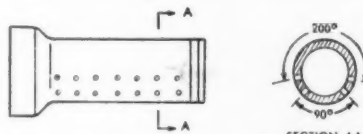
ready to go to work without spotting and without projecting feet that interfere with barrows or carts. Wheelers can approach from either side and leave without reversing direction. It has a V-bottom drum and double mixing blades, along with many other improvements. *Jaeger Machine Co., Columbus, Ohio.*

Earth Boring Machine to Save Time on Posts and Caissons

This hydraulically controlled earth borer will sink a 20" hole 6 feet deep in 2 minutes, according to the manufacturer. Augers are available in sizes from 9" to 24", and larger on special order; depth to about 9 ft., but greater on special order; skid mounted, with its own engine. Attachments include earth, clay, sand, rock and frost bits and expanding reamers. For full information write Jaques Power Saw Co., Highway 75, Denison, Texas.

Improved Design Perforated Vitrified Clay Pipe

The Bureau of Standards has accepted a new design of perforated VC pipe, and the new standard CS143-47 covers both standard and extra-strength. This new design results from war experiences and features smaller holes scientifically placed to reduce infiltration of fine material. Perforations are now ¼ inch, parallel to the axis, and 3 ins. on centers. Pipe 4 to 8-in. have four rows of perforations; 10 to 15-in. have six rows; and 18 to 24-in. have



New design perforated clay pipe.

eight rows. Copies of the new standards are available, as is information on strength and other characteristics *National Clay Pipe Mfrs., Inc., 111 W. Washington St., Chicago, Ill.*

Liquid Snow Plow Wax Helps in Snow Removal

This wax, applied to moldboards, blades and wings, creates a hard, slick surface off which even the wettest snow slides. It is applied with an ordinary paint brush and hardens quickly so that the plow can be placed in service in a few minutes. It also is a rust preventive. One gallon covers 300 sq. ft. of working surface. For details write Pennsylvania Refining Co., 2686 Lisbon Rd., Cleveland 4, O.

Dragline, Clamshell and Crane on a Crawler Tractor

There is now available for use with the D8 Caterpillar tractor an attachment which combines a dragline, clam-



Hyster clamshell on crawler.

shell and crane with a ½-yd. bucket, thus giving a dirt-moving machine with tractor mobility. Previously this had been available on the D6 and D7, the former using the ¾-yd. bucket. "Current delivery" according to the manufacturer. *Hyster Co., Portland 8, Oregon.*

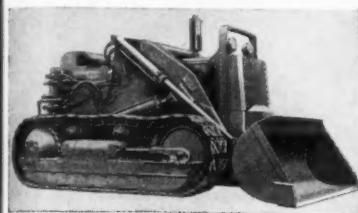
Want Your House Moved?

You might know what firm would develop this house-moving rig, an electrically operated machine designed to pick up a house and carry it away. The laborious process of jacking, block-

ing and using rollers is a thing of the past. This machine moves in, picks up the frame supporting the house—and the house with it—and drives off. You can even have the new basement dug and the old house set on. And you don't have to remove the furniture, or even pack the dishes unless you live in hillbilly land. *R. G. LeTourneau, Inc., Peoria, Ill.*

A Bulldozer Shovel, with 2-Yd. Capacity

A new, larger and more powerful unit, designed for use with the International TD-14 diesel tractor, handles 2 cubic yards, and permits the operator



Hough 2-yd. bulldozer shovel.

to raise, lower, hold or float the bucket, or to apply down pressure; also the bucket can be dumped wholly or partly at any height. The bucket extends the full width of the tractor, permitting excavation close to walls, slopes, etc. A full-width bulldozer blade can be attached in a few minutes. Also available in the 1-yard size. *Frank G. Hough Co., Libertyville, Ill.*

Cold Weather Equipment—Heaters and Thawers

Some entirely new models are shown in this catalog, including thawing outfits on wheels, single and double burner styles. They will produce up to 2000°F flame heat, quickly and efficiently. For a guide list on what is available for keeping the job going all winter, ask for Bulletin 1047. *Hauck Manufacturing Co., 124-136 Tenth St., Brooklyn 15, New York.*

Packaged Power Take-Off for Dodge

Davey Compressor Co., Kent, O., produces a packaged type power take-off for Dodge power wagons for use

on air compressors, generators, concrete mixers, welders, pumps, blowers, rock crushers and many other purposes. The unit is furnished ready for immediate installation, with nothing to fit or adjust. Full information from the manufacturer.



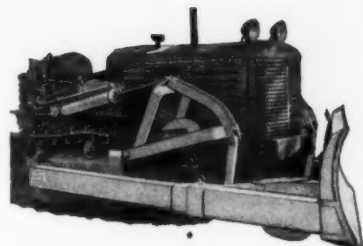
The Allis-Chalmers HD-19 diesel, now under production, will be the largest and most powerful crawler tractor.

How to Make Better Concrete

Portite is an easy-to-use liquid ready to add to your concrete, plaster or mortar, in amounts as small as a quarter of a pint per bag of cement. It makes more easily workable concrete, with less water, reduces shrinkage and honeycomb, and improves adhesive qualities and strength. An extra, but small, amount is said to make the concrete absolutely watertight. *Hopper Products, Inc., 12 E. 41st St., New York 17, N. Y.*

For Hauling Air-Entrained Concrete and Other Materials

An improved 2-yd. Dumpercrete, for hauling and placing concrete, has been developed by Maxon Construction Co., 131 N. Ludlow St., Dayton 2, O. This gives a higher discharge; also the chute can be swung to one side when direct dumping of concrete, sand or gravel is desired. Steel plate running boards provide an operating platform. A larger unit is also being announced, which will have a 3-yd. concrete capacity and a water level capacity of 5 yds. These units are especially advantageous in placing concrete in curbs, sewers or for other small jobs.



The Drott tilting bulldozer and angledoxer is now distributed by Oliver Cletrac.

Hauling and Placing Air-Entrained Concrete

A new all-purpose dump body, designed primarily for economical hauling and placing of top quality air-entrained concrete, but adaptable to the transportation of aggregate and similar bulk materials, provides a smooth, complete discharge of concrete from the bottom of the body first, preventing premature decantation of lighter materials from the top of the load and eliminating segregation and bleeding. Elimination of all excess weight and unnecessary mechanism permits direct pours without wheeling or bugging as the unit is easily maneuvered even on subgrades. Complete details are available in Bulletin CD-1. *Hercules Steel Products Corp., Galion, Ohio.*

An Easy Way to Get Air-Entrained Concrete

An ingredient easy to use in either the liquid form—one pint to a cubic yard of concrete—or powder form—one pound per cubic yard—is available to produce air-entrained concrete, which has many advantages for public works uses. For best results, the amount of air must be controlled between 3% and 5%. A compound Ayr-Trap is now available. A small deviation from the proper amount will not increase or de-



Woodtrem is a new wood preserving paint, especially for wood to be placed underground. Write Speco, Inc., 3142 Superior Ave., Cleveland, O., for data.



Davey packaged power take-off on Dodge truck.

crease the amount of air sufficiently to do any harm; the amount used is relatively independent of the proportion of sand used, and of the slump of the concrete and the mixing time. It contains no accelerators or set correctives and is stable. It is therefore especially easy to use under ordinary field conditions. Scientific data and full information on request. *A. C. Horn Co., Inc., Long Island City, N. Y.*

Blaw-Knox Post-War Highway Construction Equipment

Redesign of proven highway equipment and development of new items include: A revolutionary type of road subgrader that utilizes vibration to disintegrate and cut through the material to be excavated; a stream-lined concrete-truck-mixer; a high-speed vibratory paving spreader which can handle the output of two dual-drum paving mixers; a finishing machine with various speed and finishing combinations; a new type of widening finisher for modernizing narrow roads; a new portable bulk cement plant, permitting easy expansion; and an articulated type of face form for concrete curb and gutter, permitting important labor savings in this work; and other equipment. *Blaw-Knox Co., Pittsburgh 22, Pa.*

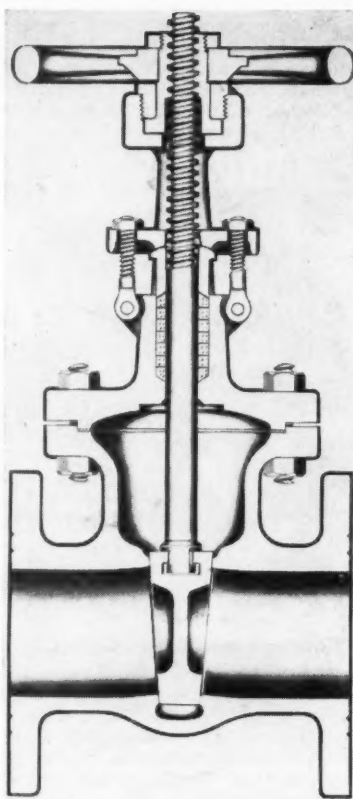
A New and Handy Type Lift Truck

A heavy duty lift truck embodying a radically different design is now in production at Mixermobile Manufacturers', Portland, Oregon, plant. The main feature of this new type lift truck is the hydraulic lift that will handle 6000 pounds to a height of eight feet, or 4000 pounds to eleven feet, yet collapse completely into the truck body like the bellows of a camera. With the lift in lowered position there is no track or front obstruction.

The "Wagnermobile" lift weighs 7425 pounds with fork and boom, but works in narrow, tight quarters. Scoop type buckets in both $\frac{1}{2}$ yard and $\frac{3}{4}$ yard capacities can be used.

New Corrosion Resistant Valves

Corrosion-resistant valves, $2\frac{1}{2}$ to 6-in., globe and gate, for pressures up to 150 psi. and temperatures up to 350F, are designed for installations

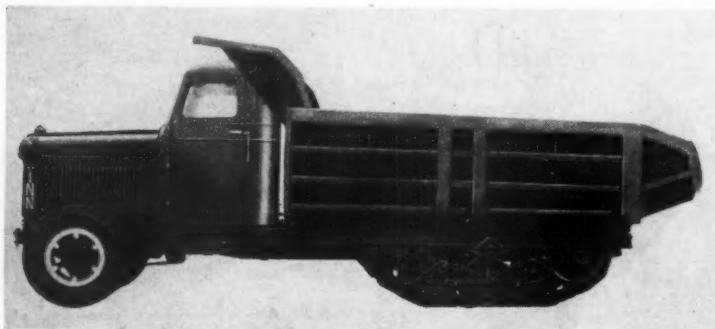


Crane corrosion resistant valve.

handling corrosive materials, chemicals, etc. Stem threads are outside of the valve; the stuffing box contains 7 to 10 packing rings. They are made in either 18-8 Mo or Monel metal. *Crane Co., 836 So. Michigan Ave., Chicago, Ill.*

A Tractor, a Motor Grader and an Engine

The Caterpillar 212 motor grader now has a 45 hp. diesel engine, giving it greater speed and output for road, street and airport maintenance, land leveling and snow removal. It has four forward speeds, power operated controls, and other new devices. The new D2 tractor is a diesel, 32 hp., designed to handle auxiliary tools on many operations. The diesel D 311 engine is



The new Linn D-15 halftrak has diesel or gas power and is valuable for snow removal, and material handling.

designed for use as an industrial power unit and electric set, for operating crushers, and for similar work. *Caterpillar Tractor Co., Peoria, Ill.*

To Do a Multitude of Small Jobs

An electric all-purpose impact tool has been announced by Ingersoll-Rand to apply and remove nuts, drill, ream and tap holes, drive and remove screws and studs, etc. It weighs only $6\frac{1}{2}$ pounds

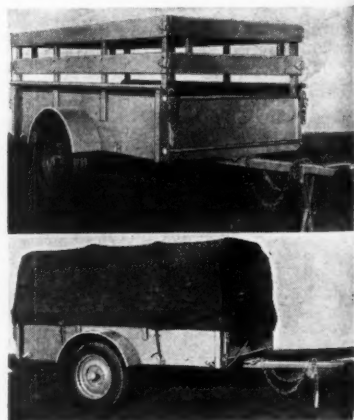


All-purpose impact tool.

and works on 110-v current, AC-DC. This runs like any electric tool until the spindle rotation resistance reaches a certain amount when the power of the motor is converted into rotary impacts. Ask for Form 5030, Ingersoll-Rand Co., 11 Broadway, N. Y.

A Useful Two-Wheel Trailer

This 2-wheel trailer has a wide adaptability for use in many fields. It is made in two sizes, 6 ft. and 8 ft. long, both 4 ft. wide. Body extensions are available for the larger unit. End gates swing from the top as well as the bottom, making it easy to dump bulky



Cobey 2-wheel trailer.

materials. Tires are 6x16; the trailers have steel fenders, tail light and other necessary appurtenances. Write for details to Perfection Steel Body Co., Gallon, Ohio.

Chemical Catalog

The new chemical catalog of the Burrell Technical Supply Co., 1942 Fifth Ave., Pittsburgh, Pa., is avail-

erial power
operating
rk. Cater-
VII.

all Jobs

mpact tool
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able. Ask for No. 247. It includes an
extensive listing of laboratory chemi-
cals with special listings of interest to
various specific analysts.

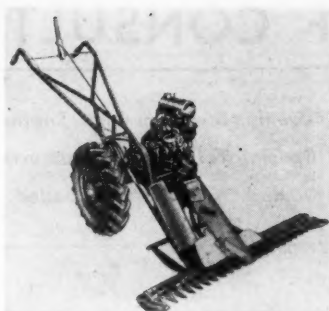
Portable Crusher, 20 to 60 Tons Per Hour

A self-contained portable crushing
unit of the cone type, with a capacity
of 20 tons per hour of ¾-in. stone to
60 tons per hour of 1½-inch, is avail-
able in a modern and easily handled
form. While especially designed for



The Symons-Nordberg crusher.

contractor service, it is efficient for
semi or fully portable service, or for
stationary operation, for counties, cities
and towns. The product can be taken
off by belt conveyor on any of three



The Easter tractor mower, also convertible to a 48-in. wide snow plow.



sides of the unit. Engine is 50-55 hp.,
diesel or gasoline. It can be transported
without disassembling drive or piping or
draining oil. Nordberg Mfg. Co., Mil-
waukee 7, Wisc.

A Handy Tool—We'd Like One Ourselves

Here is a most useful and money-
saving tractor for hand operation which
will mow lawns, parks and golf courses;
plow snow from sidewalks, parking
places, airplane servicing areas, and the
fronts of public buildings; light ter-
racing and grading; light bulldozing;

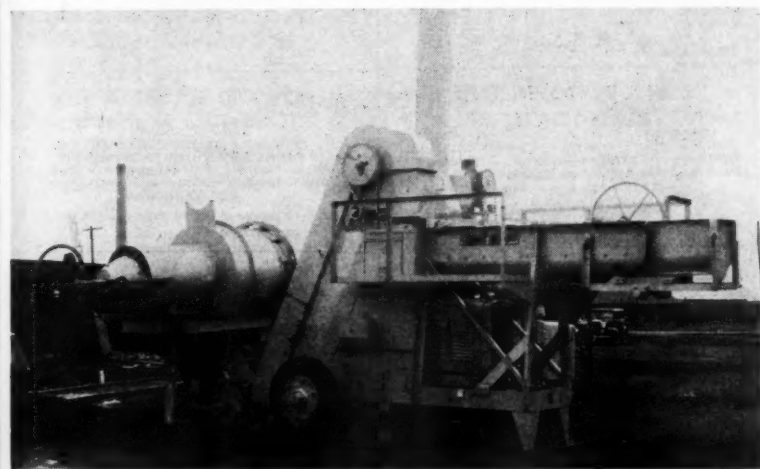
chopping up packed snow with a disc;
and will act as a power unit. It is made
in 1.5 and 2.4 hp. The latter will push
a 48-inch snow plow. The operator sim-
ply guides the unit. Tires are 500x12,
pneumatic, giving plenty of traction.
Write for full information.—Eastern
Tractor Mfg. Corp., Kingston, N. Y.

Portable, Highly Accurate pH Meter

Here is a new instrument, of wide
versatility, with built-in temperature
compensation, which can be plugged
into any 110-v., 50-60 cycle AC line.
It weighs only 14 pounds. pH mea-
surements can be made to 0.03 pH unit
and millivolt readings, within the lim-
its of 0 to about 410, to within 2mv.
Standardization with one buffer gives
accurate measurements over the full
range of the instrument. Detailed litera-
ture on request. Beckman Instruments,
National Technical Laboratories, 820
Mission St., So. Pasadena, Calif.

LaPlant-Choate Rubber Tired Tractor-Scraper

The first of LaPlant-Choate's rubber
tired equipment, the "moto-scraper,"
is a high-speed tractor-scraper combina-
tion consisting of a 2-wheeled tractor,
with rubber tires, and a 17.5-cu. yd.
scraper, assembled to form a single
integral self-propelled unit. It has a
225-hp. diesel engine, with speeds to
18 mph. This unit marks the beginning
by this company of the transition from
track-type to rubber. Write LaPlant-
Choate Mfg. Co., Cedar Rapids, Iowa.

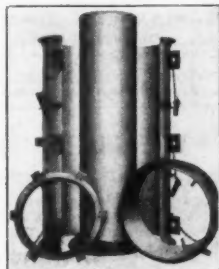


The Cedar Rapids "Patchmaster" asphalt plant.

ATLAS FORMS FOR CONCRETE PIPE

Whether it is concrete pipe for sewers, culverts, drains, irrigation or
other purposes, installed under normal or unusual conditions, let us
show how ATLAS SPEED FORMS can save production time and money.

Rugged reinforced steel and welded steel fittings—all parts heavily
built to stand the "racket," yet provid-
ing fast and easy operation, both in
setting up, filling and removal of pipe.
No clamps, hooks or gadgets to fuss
with—nothing to get out of order.



Please write
for full
information

CFC
CONCRETE FORMS CORP.
IRVINGTON 66 • NEW YORK

CUT TALL GRASS...WEEDS... BRUSH Faster and Easier

Ideal for water works, sewage plants, parks,
playgrounds, airports, vacant lots, roadsides,
tourist camps. Mows fast and clean
around trees, fences, buildings, tanks,
and tight places. Self-propelled. Easy
to handle on rough ground
or steep slopes. Does work
of eight men. Easy for one
man to load on truck. Rug-
ged. Dependable. Economical.

JARI PRODUCTS, Inc.
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MINNEAPOLIS 8, MINNESOTA



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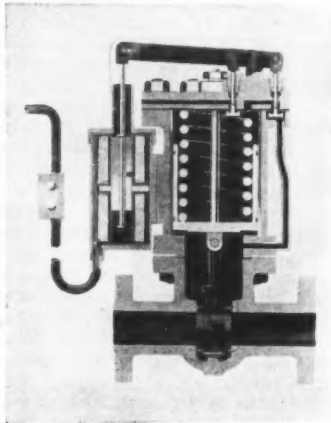
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Hard Overlay Welding.—An 8-page technical bulletin describing specific procedures for repairing worn equipment, solving problems of abrasion, corrosion and friction, and telling how to produce hard overlays with low temperature. Eutectic Welding Alloys Corp., 40 Worth St., New York, N. Y.

Angling Blade Bulldozer.—An 8-page booklet describes the cable-controlled angling blade bulldozer for D8 and D7 track-type tractors. Caterpillar Tractor Co., Peoria 8, Ill.

Shovel Dippers.—A 40-page bulletin describes the Amsco manganese steel shovel dippers, and devotes much space to the advantages of this material in solving maintenance and wear problems. American Manganese Steel Div., Chicago Heights, Ill.

Brooms, Distributors, Supply Tanks and Heaters. essential equipment in highway construction, are described in a new folder by Littleford Bros., 457 East Pearl St., Cincinnati, Ohio.

Small-Size Tournapull.—A publication by LeTourneau, Inc., Peoria, Ill., describes a new small unit for one-man dirt-moving; travels 23 mph. at top speed; self loads 3.3 yds. of dirt. It grades, moves materials, digs and loads, and strips.

Six-Wheel-Drive Trucks.—A descriptive folder illustrates the line of 6-wheel drive trucks manufactured by the Four Wheel Drive Auto Co., Clintonville, Wisc.

Mass Production of Homes.—An 8-page booklet tells about LeTourneau's method of mass production of homes by the "Tournalayer." R. G. LeTourneau, Inc., Longview, Texas.

Road Construction and Repair.—Highway brooms, pressure distributors, supply tanks, steam tank car heaters equipment is described in a typical Littleford bulletin containing good information for roadbuilders. Littleford Bros., Inc., 452 E. Pearl St., Cincinnati 2, O.

Protecting Structural Steel.—A 4-page folder on the use of Rockcote Zinc Chromate, which is available in red, green and yellow, for application to gas holders, construction equipment, bridges, etc. Rockford Paint Mfg. Co., Rockford, Ill.

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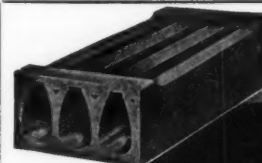
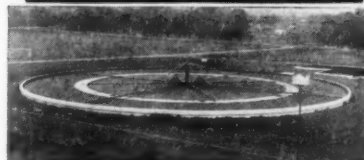
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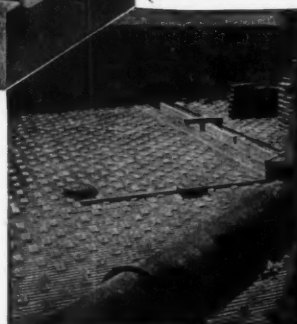
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432. New bulletin illustrates Builders Air Relay system for liquids containing suspended solids like sewage. Eliminates corrosion, clogged pipes, etc. "The Selection of Main Line Meters," a highly informative and useful presentation, describes forms of differential producers and quickly solves typical problems with the use of graphic charts. Write Builders-Providence, Inc., Dept. P.W., 9 Coddling St., Providence 1, R. I.

Does Air Sabotage Your Pipe Lines and Pumps?

357. Automatic Air Release Valves for water, sewage and industrial uses automatically vent air accumulations. Ask for latest illustrated engineering bulletins. Simpex Valve & Meter Co., 6750 Upland St., Philadelphia 42, Pa.

How to Make Concrete Pipe on the Job

440. Making concrete pipe on the job to give employment at home is the subject of a booklet sent on request by Quinn Wire & Iron Works, 1621 12th St., Boone, Ia., manufacturers of "Heavy Duty" Pipe Forms.

Concrete Pipe With Greater Elasticity

442. Lock Joint Reinforced Concrete Sewer Pipe, Pressure Pipe, Culvert Pipe, Centrifugal Pipe and Subaqueous Pipe is described and illustrated in bulletins available from Lock Joint Pipe Co., Ampere, N. J.

How to Make Better Sewer Pipe Joints

447. How to make a better sewer pipe joint of cement—tight, minimizing root intrusion, better alignment of joint. Permits making joints in water-bearing trenches. General instructions issued by L. A. Weston, Dept. P.W., Adams, Mass.

Save Trucks and Labor In City Rubbish Collection

459. For saving trucks, labor, and time in city rubbish collection get details of the new Dumpster-Kolektor described in literature just published by Dempster Brothers, Inc., 996 Higgins, Knoxville 17, Tenn.

How to Get Automatic Removal of Screenings

460. Be assured of uninterrupted, constant automatic removal of screenings. Folder 1587 tells how. Gives some of the outstanding advantages of "Straightline Bar Screens" (Vertical and inclined types). Link-Belt Co., Dept. P.W., 2045 W. Hunting Park Ave., Philadelphia 40, Pa.

An Incinerator Necessity

463. Recuperator tubes made from Silicon Carbide and "Fireclay" Corebust-ers for maximum efficiency are described and illustrated in bulletin No. 11 issued by Fitch Recuperator Co., Dept. P.W., Plainfield National Bank Bldg., Plainfield, N. J.

How You Can Dispose Of Sewage Solids

464. Nichols Herreshoff incinerator for complete disposal of sewage solids and industrial wastes—a new booklet illustrates and explains how this Nichols incinerator works. Pictures recent installations. Write Dept. PW, Nichols Engineering and Research Corp., 60 Wall Tower, New York 5, N. Y.

Ask for This Design Data On Sprinkling Filters

469. Design data on sprinkling filters of Separate Nozzle Field and Common Nozzle Field design as well as complete data on single and twin dosing tanks, and the various siphons used in them, for apportioning sewage to nozzles. Many time saving charts and tables. Write Pacific Flush Tank Co., Dept. P.W., 4241 Ravenswood Ave., Chicago 13, Ill.

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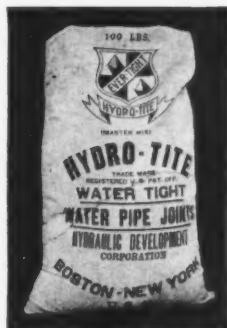
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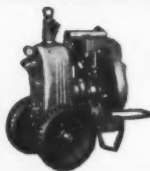
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Useful Design Data on Sedimentation Tanks

482. "Sedimentation with Dorr Clarifiers" is a complete 36-page illustrated catalog with useful design data. Ask The Dorr Company, Dept. P.W., 570 Lexington Ave., New York 22, N. Y.

Packaged Sewage Treatment— Just Right for Small Places

488. "Packaged" Sewage Treatment plants specifically developed for small communities—100 to 3,000 population. Write for full description and actual operating data for this type of plant. Chicago Pump Co., 2348 Wolfram St., Chicago 18, Ill.

Need Equipment for Small Sewage Plant?

491. Small type Conveyor Sludge Collector and Skimmer, Grit Collector, Aero-Filter and other equipment for small sewage treatment plants are described and illustrated in bulletins from Chain-Belt Co., 1722 West Bruce St., Milwaukee 4, Wis.

Glazed Clay Blocks for Trickling Filter Underdrains

492. Illustrated bulletin describes the Natco Unifilter block of glazed, hard burned clay for underdraining filter beds. Write National Fireproofing Corp., Pittsburgh 12, Pa., for free copy.

Filter Blocks for Any Trickling Filter Installation

544. Accelo Hi-Cap Filter underdrain blocks are designed to meet every requirement of trickling filter operation. For folder giving specifications, dimensions and details of construction write Inflico, Inc., 325 West 25th Place, Chicago 16, Ill.

Low Cost Air for Sewage Disposal

602. All interested in low cost air for sewage disposal will want a copy of this useful booklet. Describes operating principles and specifications of Roots-Connorsville Aerating Blowers. Write to Roots-Connorsville Blower Corp., 301 Valley Ave., Connorsville, Ind.

Biofiltration for Economical Secondary Treatment

605. Biofiltration means lower first cost of filters, control of recirculation rates, less operating personnel, no fly and odor nuisance. Get all details in bulletin PW today from the Jeffrey Mfg. Co., 947-99 No. Fourth St., Columbus 16, Ohio.

WATER WORKS

Hydraulic Pipeline Scraper For Water and Sewage Mains

382. For a copy of this compact folder on a hydraulic pipeline scraper which cleans all kinds of mains from 4 inches to 14 inches write to Dept. PW, Carver-Stimpson Pipe Cleaning Co., Walters, Okla.

Solve Corrosion Problems With This Special Alloy

391. "Everdur Metal" is title of an 8-page illustrated booklet describing advantages of this corrosion-resisting alloy for sewage treatment equipment, reservoir, and waterworks service. Dept. P.W., The American Brass Co., 25 Broadway, N. Y. C.

To Measure, Mix, Feed Chlorine or Other Gases

397. Everson SterElators. Bulletins 1063, 1066, 708 and others describe this device for measuring, mixing and feeding chlorine or other gases in solution. Capacities range from 1/4 lb. to 2,000 lb. of gas per 24 hours. Address: Everson Manufacturing Co., 214 W. Huron St., Chicago 10, Ill.

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399. Safe water may be one of the civic improvements your citizens expect soon. Feeders of all types including Hypochlorinators, Reagent Feeders, Dry Chemical Feeders, Chlorinators and Ammoniators for feeding all of the usual chemicals used in sanitation practice. Ask for latest catalogs. Dept. P.W., Wallace & Tiernan Co., Newark 1, N. J.

Chem-O-Feeders for Automatic Chemical Feeding

400. For chlorinating water supplies, sewage plants, swimming pools and feeding practically any chemical used in sanitation, treatment of water and sewage. Flow of water controls dosage of chemical; reagent feed is immediately adjustable. Starts and stops automatically. Literature from % Proportioners, Inc. % 96 Coddling St., Providence 1, R. I.

Helpful Data on Hydrants

405. Specifications for standard AWWA fire hydrants with helpful instructions for ordering, installing, repairing, lengthening and using. Issued by M. & H. Valve & Fittings Co., Dept. P.W., Anniston, Ala.

All Kinds of Valves And Hydrants

407. Hydrants and Valves. Catalog P. W. covers fire protection appliances, including hydrants, gates and check valves. Catalog also describes sluice gates, shear gates, and flap, mud, gate, check and foot valves. Address: Mueller Company, Chattanooga, Tenn.

Complete Data on Gates, Valves, Hydrants

414. Gate Valves. Double disc bronze mounted, sizes 2" to 72" hand, hydraulic, electric or pneumatic operating. Rising or non-rising stem. Bulletin X. Address: Rensselaer Valve Co., Troy, N. Y.

88 Page Book Helps Solve Water Problems

423. pH and Chlorine Control. A discussion of pH control and description of comparators, chlorimeters and similar devices. An 88-page booklet. W. A. Taylor & Co., 7304 York Road, Baltimore 4, Md.

It's Easy to Use This Leak Locator

426. Leak Locators. Again available to waterworks superintendents, the Globe line of leak locators, dipping needles and pipe finders. Several leaflets describing the original Geophone leak locator, Little Wonder pipe phone, and the Magnetite Dipping Needle. Globe Phone Mfg. Corp., Dept. P., Reading, Mass.

Find Your Leaks In a Jiffy

427. For tracing buried pipes and finding hidden leaks get details of Allen-Howe Leak Detectors, Pipe Locators, Dipping Needle and Pipe Phones. Ask for new circular P.W. 6, Allen-Howe Electronics Corp., 150 Main St., Peabody, Mass.

What You Should Know About Meter Setting and Testing Equipment

431. The most complete catalog we have seen on setting and testing equipment for water meters—exquisitely printed and illustrated 48-page booklet P.W. you should have a copy of. Ask Ford Meter Box Co., Wabash, Ind.

Cast Iron Pipe and Fittings For Every Need

437. Cast iron pipe and fittings for water, gas, sewer and industrial service. Super-deLavaud centrifugally-cast and pit-cast pipe. Bell-and-spigot, U. S. Joint, flanged or flexible joints can be furnished to suit requirements. Write U. S. Pipe and Foundry Co., Dept. P.W., Burlington, N. J.

Do You Have This Data On Cast Iron Pipe?

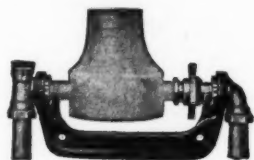
438. "Cast Iron Pipe and Fittings" is a well illustrated 44 page catalog giving full specifications for their complete line of Sand Spun Centrifugal Pipe, Fire Hydrants, Gate Valves, Special Castings, etc. Will be sent promptly by R. D. Wood Co., Dept. P.W., Public Ledger Building, Independence Square, Philadelphia 5, Pa.

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444. One-man-operated Hydraulic Pipe Pusher pushes pipe through ground under streets, sidewalks, lawns and other obstacles. Pays for itself in man hours saved on first few jobs. For complete facts and prices, ask for booklet S-117, Greenlee Tool Co., 2042 Columbia Ave., Rockford, Ill.

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Interesting Facts About Transite Pipe

445. Two new illustrated booklets, "Transite Pressure Pipe" and "Transite Sewer Pipe" deal with methods of cutting costs of installation and maintenance of pipe lines and summarize advantages resulting from use of Transite pipes. Sent promptly by Johns-Manville Corp., Dept. P.W., 22 East 40th St., New York 16, N. Y.

Need a Water-Tight Pipe Joint?

449. Full information on "Hydro-Tite" jointing compound for bell and spigot pipe, together with specifications, instructions; and illustrations both on it and "Fibrex" sanitary joint packing are contained in handsome 48-page booklet. Address: Hydraulic Development Corp., Dept. P.W., 50 Church St., New York.

How to Estimate Quantity Of Joint Compound Needed

450. The uses of Tegul-Minerallead for bell and spigot pipe and G-K Sewer joint compound are described in a 16-page illustrated booklet issued by Atlas Mineral Products Co., Mertztown, Pa. Includes useful tables for estimating quantities needed.

Data on High Efficiency Well Water Systems

454. Installation views and sectional scenes on Layne Vertical Centrifugal and Vertical Turbine Pumps fully illustrated and including useful engineering data section. Layne Shutter Screens for Gravel Well Wells. Write for descriptive booklet P.W., Adv. Dept. Layne & Bowler, Inc., Box 186, Hollywood Station, Memphis 8, Tenn.

Oil or Water Lubricated Turbine Pumps

456. Oil lubricated turbine pumps with open impellers. Five types of heads available. Specifications and illustrations in new bulletin 6930M-2 issued by Fairbanks, Morse & Co., Dept. P.W., 600 So. Michigan Ave., Chicago 5, Ill.

Want Clear, Soft, Iron-Free Water?

467. Water Softening. The use of the Spaulding Precipitator to obtain maximum efficiency and economy in water softening is described in this interesting technical booklet. Permutit Co., Dept. P.W., 330 W. 42nd St., New York 18, N. Y.

Are You Thinking About A Swimming Pool?

472. Data and complete information on swimming pool filters and recirculation plants; also on water filters and filtration equipment. For data, prices, plans, etc., write Roberts Filter Mfg. Co., 640 Columbia Ave., Darby, Pa.

Have You a Water Conditioning Problem?

481. Installation-tested equipment for complete municipal and industrial systems or individual units. Illustrated and described in latest booklets from Dept. P.W., American Wells Works, Aurora, Ill.

Treating Water With Copper Sulphate

496. "Use of copper sulphate in water treatment plants" contains valuable data on chemicals, dosage, etc. Ferri-floc Ferric Sulphate—a new, valuable booklet P.W. on coagulation for water and sewage treatment plants. Write Tennessee Corporation, Atlanta 1, Ga.

Outdoor Water Service Devices That Do Not Freeze

506. Data on anti-freeze outdoor drinking fountains, hydrants, street washers, etc., contained in Catalog L. Sent promptly on request to Murdock Mfg. & Supply Co., 428 Plum St., Cincinnati 2, Ohio.

Here's Data on All Swimming Pool Needs

508. Well illustrated bulletin describes Filters, Water Softeners, Hydrogen Ion Plants and Complete Equipment for Swimming pools, etc. Copy sent on request by Dept. P.W., Chemical Equipment Co., 223 Center Street, Los Angeles 54, Calif.



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USE COUPON ON PAGE 69

A "QUI VIVE" NAME

We wish to have it said that Murdock is on the alert, fore-handed.

In looking into 1948 we see brass and bronze continuing on the list of scarce metals.

Therefore, it is not too early for Supts. of Water Depts. to anticipate their requirements for next year.

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PERSONAL NEWS

Ray F. Goudey, widely known sanitary engineer, and for the past 17 years engineer for the Department of Water and Power of Los Angeles, Calif., has been appointed to direct the newly formed Sanitary Engineering Division of Truesdail Laboratories, Inc., Los Angeles. Under Mr. Goudey's direction, a broad program of work has been planned.

Bowe, Albertson & Associates, Consulting Engineers of 110 William St., New York, have established Connecticut offices at 2082 Kings Highway, Fairfield, Conn.

Elmer E. Isgren has been appointed vice-president in charge of production for R. G. LeTourneau, Inc., Peoria, Ill.

Gannett, Fleming, Corddry and Carpenter, Inc., Consulting Engineers of Harrisburg, Pa., have undertaken the work necessary for the extension of the Pennsylvania Turnpike from Carlisle to Philadelphia. The work is being done under the overall direction of Roger B. Stone, Chief Engineer of the Turnpike Commission.

Fred W. Morse and Fred W. Plapp, both of Worthington, O., have been added to the engineering staff of Universal Concrete Pipe Co., Columbus, Ohio.

O. T. Christerson Co., 3900 So. Wabash Ave., Chicago, Ill., have been appointed agents in that area for Ralph B. Carter Co., Hackensack, N. J.

E. D. Wallace has been made sales manager of the Buckeye Traction Ditcher Division of Gar Wood Industries, with headquarters at Findlay, Ohio.

Highway Research Board Meeting

The 27th Annual Meeting of the Highway Research Board will be held at the NRC Building at 21st and Constitution Ave., on December 2, 3, 4 and 5. The six departments of the Board and many of the 65 project committees will meet.

JOBS FOR ENGINEERS

The University of Texas, Medical School, is looking for an Associate Professor for work in sanitary engineering; pay is about \$4,500. Write Dr. Allen Scott, at Galveston, Texas.

ENGINEER SEEKS CONNECTIONS

CIVIL ENGINEER, registered, graduate sanitary engineering course, 20 years experience design, construction and surveys. Write care Box 106, Public Works Magazine.

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